THE APPLICATION OF GEOGRAPHICAL INFORMATION SYSTEMS FOR URBAN PLANNING AND MANAGEMENT: A Case Study of Squatter Settlement Planning in Kuala Lumpur, Malaysia

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I hereby declare that this thesis was composed by me and the work is my own research.

Ahris bin Yaakup
December 1991

ABSTRACT

In the past, the accepted method of plan making was to survey the area, analyse its problems, and produce a plan which described a state of affairs expected at some future date. The new theories adopted a continuous, cyclical systems approach based on the identification of needs and goals, the formulation and evaluation of alternative courses of actions and monitoring of adopted programmes. This process clearly requires planning to improve its ability to use information system. In Malaysia, changes to the planning legislation favour the new approach. However, there is no adequate information system to aid the process. The implications of using Geographical Information Systems for planning at the municipal level are examined in this study, initially, with reference to Kuala Lumpur as a whole but more specifically, with reference to a detailed case study of planning for the management of squatter problems. After the initial development of the GIS database, it is used to evaluate the existing characteristics of the Jinjang/Kepong Squatter Settlement. Subsequently, a number of scenarios are developed which take into account the socio-economic characteristics of the squatters, the constraints of the physical layout of existing squatter settlements, availability of land and site suitability for different kinds of development. Spatial modelling techniques are employed to examine alternative plans for the squatter areas. These plans are evaluated using cost-benefit analysis incorporated into the GIS database. A further stage in the use of GIS for the case study is the development of an interactive graphic user interface for squatter planning and management. This utilises the ARC/INFO Arc Macro Language (AML) to aid user access to alternative planning scenarios. The interface provides flexibility in data selection and display, to allow physical planners and decision-makers to view and analyse the planning scenarios interactively, before deciding on the final plan. The final part of the thesis highlights some of the problems encountered in the case study and indicates factors which need to be considered if GIS is to be employed in this type of exercise. Data requirements, problems of data availability, the appropriateness of different analytical tools are examined. This is followed by a discussion of the feedback between the information system and the planning/decision-making process which is necessary for the sucessful implementation of new GIS technology in a developing country.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In urban planning, monitoring land use change forms an integral part of the process whereby policies and strategic plans are reviewed and updated. This task typically involves the identification of emerging land use patterns which are normally linked with other planning statistics such as employment, housing and population before the full significance of land use changes are apparent. This task is made difficult in many parts of the developing world where rapid urbanisation is presently taking place. An additional factor to be considered in the planning process is dealing with the equally rapid growth of the informal sector in urban development. This requires planning programmes to be adapted during their implementation as and when incoming information requires such changes. The advent of Geographical Information Systems (GIS) has created a large field of opportunity for the development of new approaches to computer processing of geographically referenced data, which will add a new dimension to the management, analysis and presentation of large volumes of information required in decision-making processes. The question that arises is whether the quality of planning and decision-making processes can be substantially improved by using GIS as one of the main tools of planning. With these considerations in mind, this study examines some of the issues involved in the utilisation of GIS in urban planning in Malaysia. It is focused on this country because of the author's prior knowledge of the problems involved. Malaysia is also one of the countries where the needs of urban planners are greatest owing to the extent of rapid urbanisation and economic transformation that is taking place, while the resources at their disposal are probably least. Like other developing countries, it is also the area where the impact of what Mannheim (1987) has called the Third Computer Revolution, brought about by the advent of micro-computer based technology, is likely to be greatest, because of the general lack of operational experience based upon involvement in earlier generation of mainframes and mini-computers.

1.2 Problem Statement

Malaysia is dependent on its natural resources to sustain the current economy and to ensure long-term growth. Consequently, the utilisation of the country's resources should be carried out in a rational way. Resource utilisation should not cause damage to the human environment, and should recognise the needs of future generations. Malaysia is now experiencing a rapid rate of urbanisation. Although urbanisation produces many advantages seen in terms of economies of scale, uncontrolled urbanisation produces several negative consequences. There are many symptoms of uncontrolled urbanisation. These are reflected in terms of high rates of population growth (produced by natural increase and migration), continued rural-urban migration, migration irrespective of available employment opportunities, poverty and inequality, slums, squatting, deficits in basic infrastructure and transport, pollution and finally the growing weakness of government agencies to administer and finance development.

Kuala Lumpur, being the capital city of the country perhaps faces the most serious urban problems in Malaysia as compared with other urban centres. The problems have been made worse by the tremendous impact on the development of the city created by the building boom of the seventies. Most of the growth of the city had to be accommodated by its outward expansion. However, the new urban areas around the city were usually subjected to serious land use problems such as urban sprawl and scattered development, conflicting land use, squatter and slum housing settlement, an inadequate network of infrastructure, land shortages and inevitably high land prices.

It has been realised that the capital city has clearly grown beyond the capacity of the local administration to meet the increasing demands for infrastructure, housing, services and amenities (DBKL, 1984). Local government becomes ineffective if it remains static and if plans are not regularly revised and improved to accommodate the progressive technological and social changes in society. In an era of increasing urban problems, rising costs and heavier demands for public services, the local authority must increase its effectiveness and productivity by developing innovative ways of carrying out its functions.

Despite these problems, Kuala Lumpur still holds a special attraction for people throughout the nation. It attracts not only rural migrants who have high expectations of bettering themselves in the city but also migrants from smaller towns and cities. The uncontrolled drift of people from rural areas or small towns to the city in search of jobs creates a sudden demand for housing. As many of the migrants are unskilled and poorly educated, they are in most instances being accommodated in low income jobs such as factory work, the service sector and the informal commercial sector. The demand for large numbers of houses which have to be low priced has not been satisfactorily fulfilled, so much so, that housing solutions have been left to the ingenuity of the individual.

This has created the problems of slums and squatters as the low income migrants seek the cheapest shelter possible, either in rented rooms or squatter houses close to their workplace. As time progresses the rooming and squatter houses follow the inevitable path of physical deterioration due to poor maintenance. At the same time the shelters are lacking in health facilities, access to adequate piped-water and electricity. The whole process of physical deterioration, growing overcrowdedness and inadequate basic facilities tends to produce slums.

Although the Kuala Lumpur local authority (commonly known as the City Hall) does not condone illegal occupation of land, they have learned to accept the squatters as a product of a fast growing city (Diamond et al., 1980). The shift of policy from rejection of the squatters to accommodation and toleration is becoming clearer at present. This is to some extent reflected in a more concrete effort to bring assistance and handouts to the poor.

For City Hall which has been entrusted with the power to plan and develop the city of Kuala Lumpur, the growth of squatter settlements has proved to be a challenge to their authority and role.

To assist in exercising their development function, City Hall prepared a comprehensive structure plan for Kuala Lumpur. The plan among other things determined strategies for land development in terms of industries, commerce, services, housing, recreation, education and transportation. The plan also included the general land use zone for the Federal Territory (DBKL, 1984). With the plan it was hoped that the problem of unbalanced growth within Kuala Lumpur, which has caused problems like traffic congestion and shortage of land at particular places for economic and social development, could be solved.

The development proposals in the plan are expected to have a major impact on squatter settlements. Working on the premise that the majority of squatter areas can be developed for housing (or other suitable use) it is therefore important that systematic planning, site investigation and economic study be carried out to ascertain their development potential. Effective use of the existing area will compensate for the problem of limited supply of urban land.

The development plan exercise in Malaysia showed that attitudes towards the planning process had changed. Traditionally planning thought and practice had emphasised the land use base "master plan" concept. The new legislation however required a change of emphasis away from the "end-state" view towards the "continuous" approach to planning where the authorities are required to be more sensitive to the physical and socio-economic situation.

As regards solving squatter problems in Kuala Lumpur, all squatter settlements have now been identified. Nevertheless information on their socio-economic characteristics and the physical aspects of the settlements has not been gathered and assembled. Presuming that a majority of squatter areas could be developed for housing or any other suitable use, City Hall therefore proposed that systematic planning, engineering and economic studies be carried out to ascertain their development potential. All squatter settlements could then be methodically classified according to their development potential (DBKL, 1984). The criteria used to evaluate development potential could include ease of implementation (technical feasibility and phasing), economic feasibility or consideration of other implementation priorities. This would enable the preparation of further development plans, implementation programmes and schedules for the development of selected squatter areas.

To fulfill this responsibility, the local authority should be actively involved in assembling and maintaining a database suitable for supporting decision-making. The local authority should also be capable of undertaking systematic evaluation of alternative policies, objectives and projects that are suitable for local conditions. To ensure the local authority is efficient and effective in performing these roles and functions, it should have adequate skilled manpower and utilise an appropriate methodology to handle such tasks.

With the development of new methods of spatial data handling and modelling, the expectation that such tasks can be performed is high. There is a real need to see whether such expectations can be realised. Using the planning of squatter settlements as a case study, this research will focus on the application of GIS to planning and monitoring of development within the framework of a rapidly growing urban area.

1.3 Aims of the Study

An overview of the urban management issues in Kuala Lumpur indicates a need for improvements in the current methods of planning and decision-making. The introduction of GIS-based methods allowsplanners to adopt a more systematic approach based on spatial analysis of observed trends and the generation and comparison of alternative scenarios for future development. With these considerations, this project aims:

> To formulate an approach for urban land use planning and monitoring using a combination of geoprocessing and spatial modelling techniques.

The main theme underlying this is the need to demonstrate how the application of GIS can aid urban land use planning and monitoring with particular reference to squatter settlement planning in Kuala Lumpur. The technical application of GIS will be considered in the context of typical urbanisation problems and the related planning processes.

To achieve this aim, the following objectives are formulated:

1) to review urbanisation problems and planning processes as a framework for the development and application of GIS for effective planning;

2) to develop and implement the structured GIS database required for squatter area planning and monitoring;

3) to manipulate the squatter GIS and use spatial modelling to:
   a) evaluate existing socio-economic scenarios and levels of services;
   b) evaluate the impact of the proposed development plan on the squatter area;
   c) generate and evaluate alternative solutions to the existing squatter problems;

4) to develop an interactive approach to GIS query using the Macro Language programming facilities of a commercial GIS package;

5) to evaluate the current problems and potential of GIS as a tool for urban planning, based on the case study of squatter planning in Kuala Lumpur.

1.4 Scope and Organisation of the Study

This work is organised into four parts:

Part I: Chapters 2 and 3

Part I contains a review of urbanisation and urban management issues in Malaysia. The problems of housing and in particular the squatter phenomenon in Kuala Lumpur will be discussed as a specific example. Part I also gives an account of theoretical aspects of the planning process for comparison with the system of planning currently employed in Malaysia. This forms the background for a discussion of the need for GIS in planning and management.

Part II: Chapters 4, 5, 6 and 7

Part II examines the concepts and methods of GIS and deals with the design and implementation of the GIS for the case study. Having developed the digital cartographic and attribute databases, they will be used to analyse the physical and socio-economic characteristics of the study area. This part of the thesis will also examine the impacts of alternative development policies on the specific squatter settlement chosen.

Part III: Chapters 8 and 9

Part III deals with the evaluation of alternative solutions to squatter problems. Spatial modelling techniques are employed to determine alternative development programmes for the study area. The various programmes are then evaluated using cost-benefit analysis. Also included in Part III is a discussion of the development of a user interface to the GIS, to enable interactive planning and scenario evaluation to take place.

Part IV: Chapter 10

Part IV reviews the issues, potential and prospects of using GIS in urban planning in developing countries. Drawing from the case study and comparing the result with other studies in the literature, Part IV highlights some of the problems encountered and indicates factors which need to be considered if GIS is to be employed in this kind of situation.

1.5 Outline of Methodology

The methods used in the study range from simple historical methods to analytical planning methods using a GIS approach. Historical methods were used to examine the urbanisation process in the country with emphasis on the need for decent houses and land for the poor. A review of the idealised planning process and the approach to planning actually employed in Malaysia lead to identification of the need for better urban management through the application of GIS technology to urban planning.

The case study initially used survey methods for data collection. The data from the case study were analysed and manipulated using GIS techniques. Major sources of information for applying GIS techniques were the existing base map, aerial photographs, photo mosaics, and field survey data. The socio-economic data of the squatters were gathered from household interview. The spatial and non-spatial data were then transferred to computer compatible format using the ARC/INFO system. Manipulation and retrieval facilities were employed to examine the existing physical and socio-economic characteristics of the area as well as the impact of development proposals. More advanced spatial modelling technique in ARC/INFO were also used to generate alternative solutions. A cost-benefit analysis was undertaken and the results incorporated in the GIS to allow evaluation of alternative solutions.

CHAPTER 2

URBANISATION AND URBAN MANAGEMENT ISSUES IN PENINSULAR MALAYSIA

2.1 Introduction

During the twentieth century, the world has seen the end of the pre-existing colonial system. It has also seen the modernisation of several nations, which at the turn of the century, were not for their time, modern industrial powers. They included Russia, Japan, the USA and Italy. In recent decades, accelerated development has thrust a few countries such as Taiwan and the Republic of Korea onto a platform of industrial strength, while some nations, especially in Latin America have escaped abject poverty but have not become completely modernised. In Africa we currently see a period in which the achievement of political stability and the beginning of economic progress are still goals which are widely sought.

Two undeniable facts characterise the majority of the countries in the developing process. First, in the last decade their cities have been growing massively; secondly, this urban growth has not been associated with a rate of economic growth which is fast enough to provide employment opportunities for the rapidly increasing populations. The most widespread and pervasive problem which gives rise to the latter situation is, perhaps, the lack of resources with which to alleviate the condition of poverty in the short run and promote the development of new resources in the long run. The accumulation of investments from the current flow of resources and under conditions of poverty is a painful process under any form of economic organisation. This gross shortage of resources limits severely the scope of both government and private action in planning and development. Proposals for methods of planning and for the actions to be taken must be within the reach of the existing economy even though they may contribute to its transformation.

Most developing countries have a rate of natural population increase of about 2 percent per year, and this applies almost uniformly in urban and rural areas. In addition, in many developing countries natural increase in rural areas creates underemployment which primarily pushes people to migrate to the cities. The rate of urban growth can rise to 4 percent or more per year, and the urban population, instead of doubling in thirty-five years, will do so in fifteen to twenty years (Harris, 1990). The United Nations Centre for Human Settlements (UNCHS) has calculated that the global urban population will grow from 830 million in 1985 to 2150 million in the year 2000 (Beek and Jupenlatz, 1987). The complex poverty of cities is increasing at an even more rapid rate. According to UNCHS, the population of squatter and slum areas is growing twice as fast as the total urban population (UNCHS, 1982).

Cities with growing populations require constant additions to employment facilities; to infrastructure such as roads, water supply, sewerage and electricity; to services such as schools and hospitals; and to housing and community facilities like shopping centres. Even a 4 percent rate of increase in these facilities can consume a large proportion of any corresponding growth in national income or gross national product (GNP), but the demand for the facilities can expand more rapidly than the population.

From the point of view of simply maintaining the existing status of the population, the self-supply of facilities in rural villages is far less costly than city-building. Thus, in the absence of development, or its inadequacy, the possibility of massive in-migration to the cities, driven by rural underemployment (or oversupply of labour), in the words of Harris is 'a sword of Damocles suspended over the urban centres and over the national policy' (Harris, 1990, p.19). The productive and economical management of urban growth through planning and other means is thus a key objective of development.

The problems experienced by Kuala Lumpur are not dissimilar to those faced by other cities in developing countries. Within this perspective this chapter intended to provide an overview of the situation in Kuala Lumpur. This will provide the framework in which the potential uses of GIS in support of urban planning in Peninsular

Malaysia can be examined. Since a GIS is essentially a tool of a well-defined and particular type, its effective uses should depend on the purposes for which it is applied and the context in which that application takes place.

Against this background, this chapter briefly reviews:

1 The general profile of Malaysia and the evolution of the urban system in the country;
2 The problems of urbanisation in Kuala Lumpur;
3 Issues of land and housing for the urban poor and of overall urban management in Kuala Lumpur.

2.2 A profile of Malaysia

Malaysia was established in September 1963. It comprises Peninsular Malaysia (also known as West Malaysia which attained its independence from British rule as the Federation of Malaya on August 31, 1957), the self governing state of Singapore (which left Malaysia in August 1965) and the British Colonies of Sabah and Sarawak (also known as East Malaysia). The country has a land area of 127,670 square miles, of which Peninsular Malaysia is 50,840 square miles (Fisher, 1977). Peninsular Malaysia was subdivided into 12 administrative units comprising 11 states and the Kuala Lumpur Federal Territory (Figure 2.1).

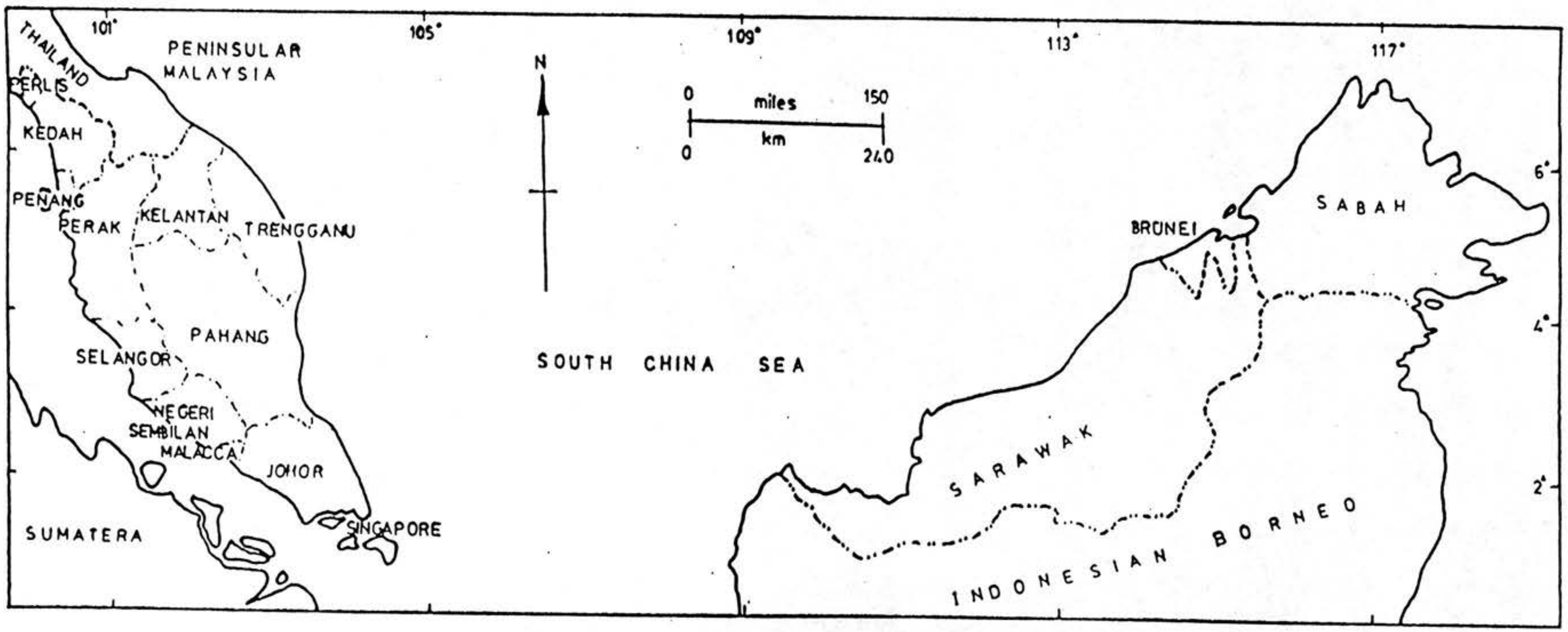


Figure 2.1: The Regions of Malaysia

Source: Yaakup, A.B. (1980) 'Regional Development in Peninsular Malaysia', Unpublished M Sc Dissertation, University of Strathclyde, Glasgow, p.2.

The population of Malaysia in 1990 is estimated at 17.9 million with an average annual rate of growth of 2.5%. About 81.7% or 14.6 million people live in Peninsular Malaysia, 8.5% in Sabah and 9.8% in Sarawak (Government of Malaysia, 1986). In Peninsular Malaysia 58.1% are Malays, 31.4% are Chinese, 9.9% Indians and 0.6% Others. Malaysia has a large number of young people. About 39.9% of the population are in the age group 0 - 14 years as compared to 52.2% of the working age group of 15 - 55 years. This indicates a high dependency ratio of about 47.8% which implies a substantial demand for the basic neccessities of life, as well as services such as education, health and housing.

With an estimated Gross National Product (GNP) per capita of $4885(1) in 1990 (Government of Malaysia, 1991), Malaysia, has one of the highest living standards of developing countries in Asia. The economic development of Malaysia has been relatively rapid. Between the period 1981 - 1985, it was estimated that the GNP in real terms grew by 7.1% per annum. However during the period 1986 - 1990 the GNP declined by 5% per annum in real terms as a result of the declining manufacturing and mining sectors. It is expected to grow again within the period 1991 - 1995 (Government of Malaysia, 1991).

The economic situation of Peninsular Malaysia is comparatively well developed. However, a deeper insight into the situation reveals distinct inter-regional and rural-urban imbalances. In general, the western part of Peninsular Malaysia is more developed than the eastern regions. Most major towns are located in the western part and migration to these towns takes place rapidly as a result of people seeking better job opportunities and urban facilities. The causes and effects of this pattern of town distribution will be discussed below.

2.3 Evolution of the Urban System in Peninsular Malaysia

Notwithstanding the existence of a few functionally important trading centres from earlier centuries, Peninsular Malaysia had no traditional urban system prior to the colonial immigrant days. Indeed, it is doubtful if Peninsular Malaysia ever experienced what is known as "primary urbanisation"(2). It is also doubtful if any of the traditional centres could be described as "orthogenetic" cities(3). However, contemporary Malaya is quite different. With over forty percent of its population classified as "urban"(4), it is indeed the most urbanised country in Asia with the exception of Japan and Israel. The present day urban system of Peninsular Malaysia has cities and towns arranged in an hierarchical order, which largely conforms to a log normal distribution and is regulated by the spatial economy functioning through the transport network. Considering that the present system of cities and towns in Peninsular Malaysia has only developed in the last 150 or 200 years, the change has been rapid and the development phenomenal.

The growth and development of towns in Peninsular Malaysia was stimulated in the late nineteenth century by the discovery of economic minerals (Yaakup, 1980). Tin in particular attracted prospectors from coastal areas to the foothills of the main range. With the introduction of rubber, other towns were established as service centres. As the industry expanded and as the railway and road network developed they assumed the role of purchasing, processing and distribution centres. Also a large number of people from India and China were imported to work in the industry and the influx of these immigrants caused the urban population to rise sharply. Thus, Malaysian towns became centres of non-indigenous people while the Malays remained undisturbed by urbanisation.

The growth of towns after the second world war was largely due to social and political forces rather than to the interplay of immigration and economic development. Migration from rural to urban areas became significant and forced the pace of urban growth. While the country's total population increased by 61% between 1931-1957, the urban population rose by 200% and the ratio of rural dwellers to those living in towns fell from 81% to 62% during the same period (Yaakup, 1980).

Another important stage in urban development in the country was during the Communist insurrection in 1948 to 1963 (more commonly known as the period of Emergency). Paradoxically, the "Emergency" necessitated the implementation of the resettlement scheme which, by moving more than half a million dispersed and scattered people into 440 "New Villages", converted part of the Malayan countryside 'into landscape of entirely new towns and villages' (Dobby, 1952). These, together with establishment of satellite towns and the upgrading of existing settlements provided the country with what can only be called a distorted pattern of urban development.

With increasing urbanisation, the rural population has tended to become numerically less significant. This trend has been accelerated by resettlement schemes and the continuous drift of rural dwellers to urban centres. A significant centripetal force was that urban centres in the Peninsular area became centres for modernisation, improvement in economic status and stable employment. In contrast, rural areas were often associated with limited opportunities and arduous agricultural work, coupled with small returns and general backwardness. The benefits of urban life include facilities for further education, improved public health and the exchange of ideas in a multi-racial society. Furthermore the modern practice of developing urban centres through conscious planning makes them an especially attractive setting to live in.

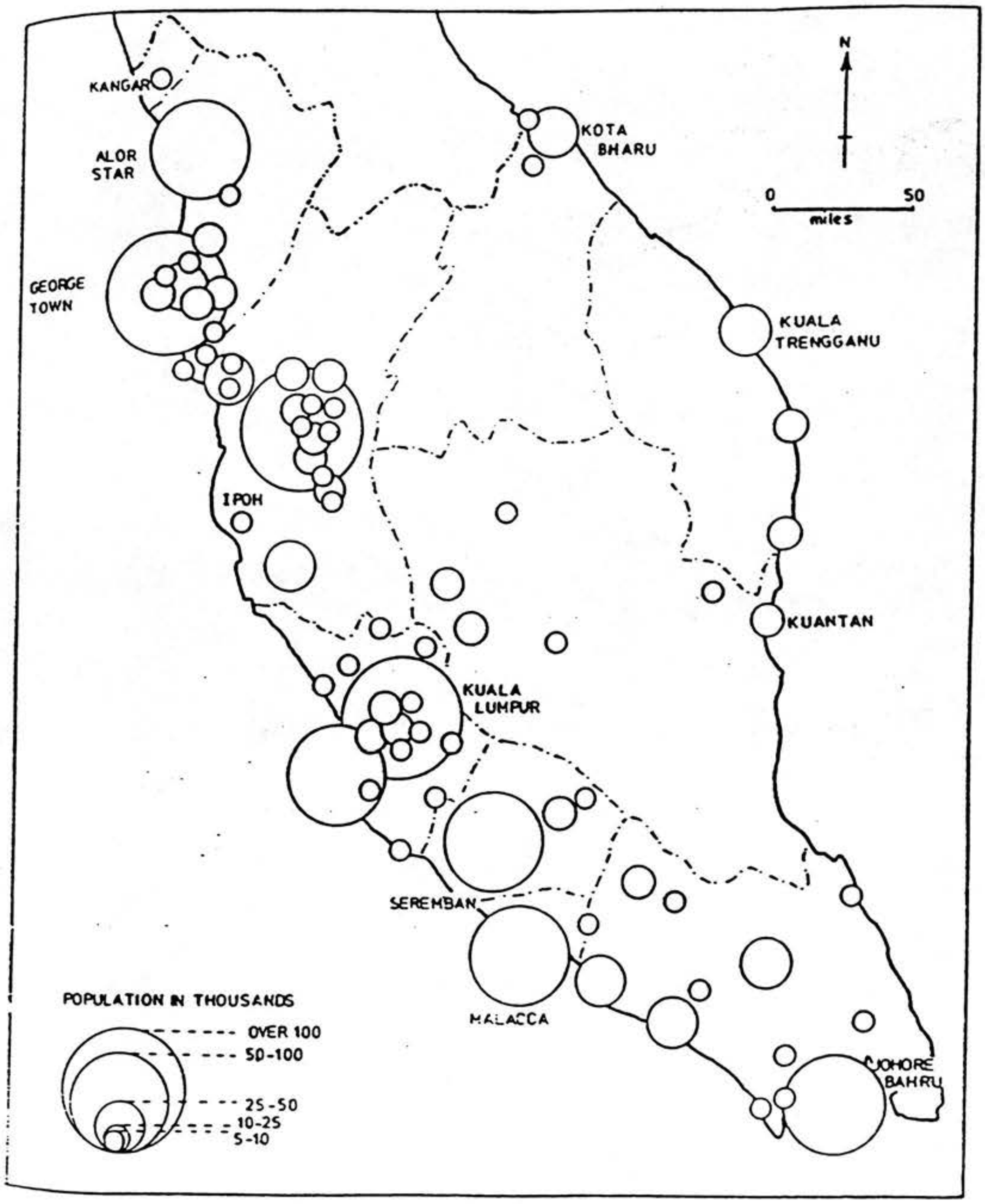


Figure 2.2: Peninsular Malaysia: Distribution of Towns (1957)

Source: Yaakup, A.B. (1980) 'Regional Development in Peninsular Malaysia', Unpublished M Sc Dissertation, University of Strathclyde, Glasgow, p.37.

Table 2.1 : Rural and Urban Population in Peninsular Malaysia, 1957 - 1990 ('000)

Year	Urban Population No	%	Rural Population No	%	Peninsular Malaysia No	%
1957	1,954.9	31.1	4,323.8	68.9	6,278.7	100
1970	3,005.1	34.1	5,796.2	65.9	8,801.3	100
1980	4,304.4	37.5	7,168.6	62.5	11,473.0	100
1985	5,326.4	41.1	7,642.4	58.8	12,968.8	100
1990	6,527.2	44.7	8,078.0	55.3	14,605.2	100

Source: Data calculated from Fifth Malaysian Plan (1986 - 1990) and The Pahang Tenggara Regional Development Studies, 1972

Between 1957 and 1970, it is estimated that 265,000 rural dwellers migrated to urban areas for better jobs or other urban facilities (Lembaga Kemajuan Pahang Tenggara, 1972). Appendix A indicates the changes in population in various settlements between 1957-1970. The urban population rose quite significantly compared to the rural population. This is especially true for centres within the size range of 20-30,000 and those with more than 50,000 peoples. It is therefore apparent that migration also occurs from small towns to major towns.

The rate of increase of the urban population is expected to remain high during the period of the Fifth Malaysian Plan (1986-1990) (Government of Malaysia, 1986). This is largely due to the rapid growth of industrial and commercial sectors and the increased rural-urban migration. As indicated in Table 2.1, the urban population is expected to have risen at the rate of 4.2% per annum, or in real terms, 5.9 millions in 1985 to 7.3 millions by the year 1990. Consequently, the percentage of the population in urban centres is estimated to have risen from 37.8% to 40.7% during the period of 1986-1990. The effect of rural-urban migration has been felt by most major towns in the country, not least the capital city of Kuala Lumpur.

2.4 Development of Kuala Lumpur

The origin and development of Kuala Lumpur is symbolic. It is more than the history of an obscure mining trading post which developed into a modern capital. The urban process of Kuala Lumpur typifies the growth of the interior urban centres and, in many respects, the evolution of the urban system in the country.

Inherent in Kuala Lumpur's development is the interplay of a host of forces. After a long period of insignificant growth of traditional settlements, a fundamental change occurred with the arrival of the first immigrant Chinese miners. These were few in number and ill-organised, and for the most part they were tolerated and even welcomed by the indigenous administration. Subsequently, however, there came a second and larger wave of immigrants, attracted by the rich profits from the mines, and financed and organised from colonial ports. Their conflicts led to the involvement and breakdown of the indigenous administration, which in turn afforded the opportunity for the British to intervene. This was followed by a brief period of contention between the immigrants and the British for administrative control. The latter of course gained supremacy without much difficulty. Finally, an equilibrium within the context of the colonial order was reached, under which the colonial administration provided the political framework and the spatial infrastructure, while the immigrant groups contributed in building the socio-economic base. The indigenous elements were peripherally absorbed socially and politically within the new colonial order, but for all practical purposes remained outside it economically.

Kuala Lumpur, like many urban settlements in Malaysia, originated from mining. Open-cast mines proliferated on the plains along the foot hills of the central mountain range. In the 19th century, the success of mining operations in the upper reaches of the Klang and Gombak rivers resulted in the development of an urban nucleus at the strategic confluence of the two rivers. Available records established that Kuala Lumpur was founded in 1859 and its creation was entirely the work of Chinese immigrants engaged in tin mining. During its early days, Kuala Lumpur was a service centre for the mining communities, controlling the movement of people and goods up and down the Klang and Gombak rivers (Figure 2.3).

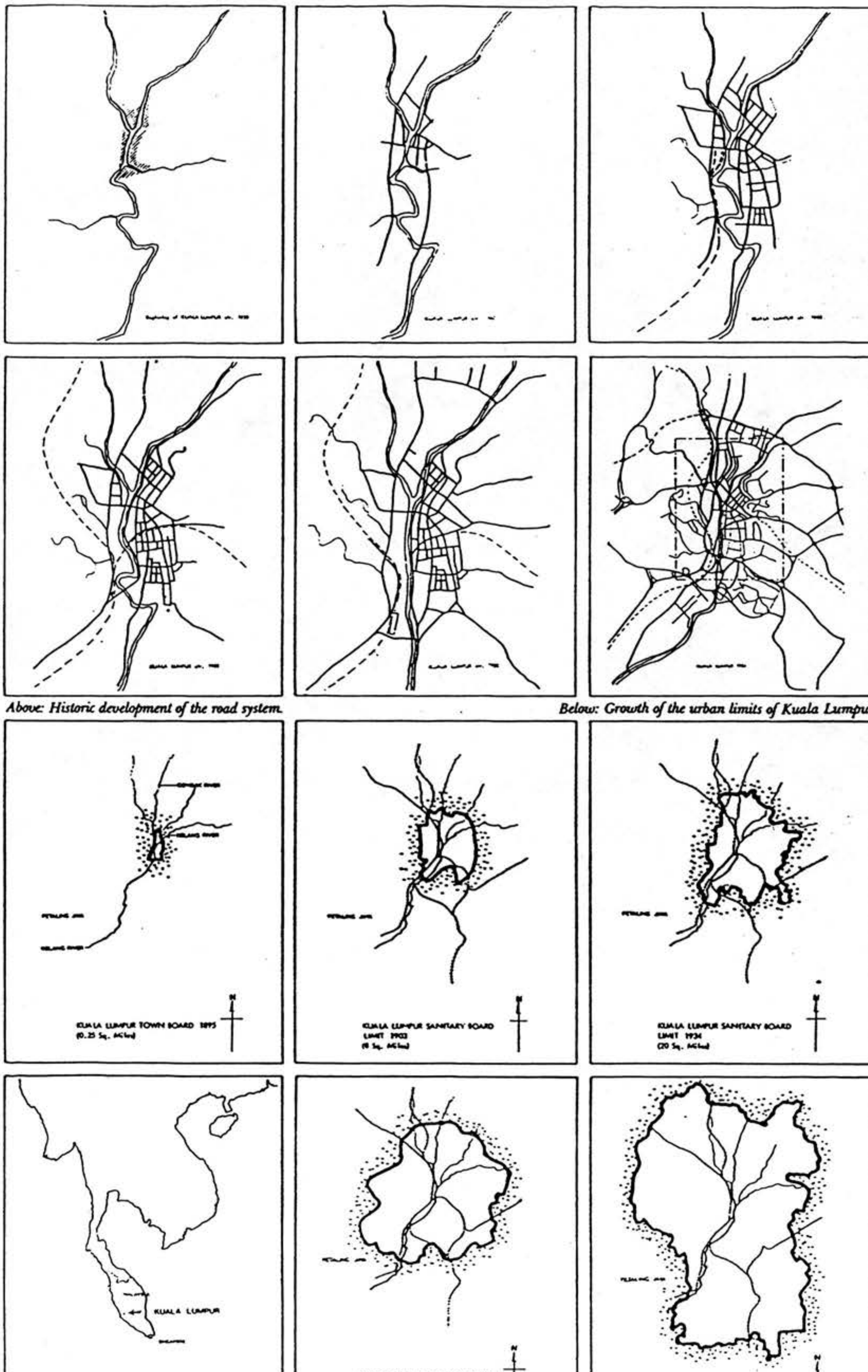


Figure 2.3: Development of Kuala Lumpur

Source: Ping, H.W. (1984) 'Development of Kuala Lumpur', International Architect, Issue 6/1984, London, p.48.

The city's expansion accelerated during the economic boom of rising tin prices around 1882, resulting in a greater influx of immigrant prospectors and traders. The population of Kuala Lumpur was around 4,000 in 1884 and around 19,000 in 1892 (Ping, 1984).

In 1886, Kuala lumpur was made the capital of the Federal Malay States. The reasons being its central position within the tin belt (Fisher, 1966) and because it happened to be an existing local administrative centre with a reasonable site (Murphey, 1957). One result of this was a change in the population. The expanding administrative and governmental functions of the city resulted in a rapid increase of the indigeneous population in Kuala Lumpur. The transformation of its role also altered the employment structure. In 1947, 75% of the total workforce was employed in the tertiary sector. The joint forces of the colonial-immigrant complex not only broadened the economic and functional bases of the city but linked it with other interior centres by the newly constructed transportation network. The evolution of the urban system was thus set in rapid motion.

Thereafter until Independence in 1957, the urban centres and urban system evolved within the framework of the colonial economy which was export oriented and spatially integrative. As the capital of the Federation of Malaya, Kuala Lumpur benefited from the concentration of administrative and political functions. Its central location within the tin and rubber belt, and its position as the nodal point of the transportation network, strengthened its local primacy. The process of urban development regulated by the colonial economy, a salient feature in the evolution of the urban system in the country, is thus embodied in the development of the capital city.

2.4.1 Rapid Growth and Planning

The population of Kuala Lumpur which stood at 2,000 in 1878 and 3,000 in 1880 (Jackson, 1963), had risen to 4,054 by 1884 and to 25,000 by 1895 (Gullick, 1955). An eightfold increase in one and half decades is very impressive by any standard. The rapid growth of Kuala Lumpur and the mining settlements around it made pressing demands on the town as regards food supply, housing and other amenities.

The increased demands of the population led to an intensification of the trade and an expansion of food crop cultivation. Apart from the exportation of tin and jungle produce, and the importation of mining equipments and foodstuffs for the miners, the traders now had to cater for the needs of a growing urban society. Home markets for padi and garden produce expanded and the improvement of transport also encouraged the cultivation of export crops. This development widened the functional base of the town itself, and helped to urbanise and commercialise its outskirts and the nearby settlements.

The post-war development of Kuala Lumpur took a different form, with repercussions for its immediate surroundings and other centres in the country. The city's development in the post-war period was influenced by a host of factors, including its status as a leading city and its capacity to accommodate surplus population from the countryside. There was also a new demographic element. Prior to 1947, population growth had always been tied to the fluctuations of the rubber and tin industries, which had influenced the inflow and outflow of alien immigrants. However a new trend developed in the capital with an increase in the numbers of Malays and hence a change in the ethnic composition of the population as a whole. This has been recognised as one of the most striking post-war features in urban development and significantly it was common to many of the other towns.

2.4.2 Functional and Physical Expansion

During the Japanese occupation of Malaya (1941 - 1945), uncontrolled temporary buildings were put up on a large scale. With more people drifting back to the towns when the country came under the British Millitary Administration at the end of the war, the capital found itself further burdened with an increased number of temporary structures and military camps inside its urban limits. Efforts were made to check unauthorised building and temporary development was planned, but the shortage of permanent housing and demand for accommodation rendered futile the endeavours of the local authority.

An important element of the urban ecology of Kuala Lumpur, whose origin must be mentioned, is the squatter settlements. These grew up during the Japanese occupation, when an impoverished economy brought many people of the immigrant Chinese and Indian labouring class into the town in search of a living (Bennet, 1961). The squatters built their huts on low lying marshy plains in the heart of the town. The insecurity of their tenure, their low incomes and poor housing posed severe problems of administration. The squatter problem worsened with the establishment of the New Villages built just outside the city boundary, during the Emergency. An increase in the number of households in the New Villages resulted in a further demand for housing. On account of family ties and low earnings, houses were conveniently built in vacant lots and ex-mining land in nearby areas. A number of squatter settlements were established in this manner, for example the Jinjang/Kepong settlement which is to be the subject of further investigation in later chapters. The extension of the city's boundary in 1974 (Figure 2.3) incorporated the new villages along with several squatter settlements including the Jinjang/Kepong settlement within the city area.

The magnitude of the problem was reflected by the fact that during the period 1947 - 1951, plans for about 2,000 permanent accommodation units were approved, but not more than 1,200 were actually constructed, while approximately 10,000 temporary houses were built within the town limit (Concannon, 1955).

To add to the seriousness of the accommodation situation, unauthorised commercial and residential development also took place in residential and commercial quarters of the capital. Private landownership and topography, among other things made planning and urban expansion difficult, both in the central area and on the fringes of the town.

The unauthorised development of housing undoubtedly contributed to overcrowding in the city. The growth of the capital, however was due to the increased concentration of multiple functions. Apart from the main functions of administration, commerce and transportation, on which the city thrived, industrial and cultural functions also began to assume importance and contributed substantially as city-building factors.

In the 1950's the city became an important centre of cultural dissemination. It served as the venue for religious and cultural gatherings, and was the national centre for higher education. It boasted several large and distinguished secondary schools, teacher training colleges, a technical college and, dating from independence, a division of the University of Malaya.

The main growth-contributing factors remained the concentration of administrative, commercial/transportation and communication functions. The enlarged territory, the concentration of administration under a strong central government, and the improved transport networks, all made for the development of a "big-city" capital of a fast-growing country, and the rapid transformation of the "small-town" capital image which had characterised Kuala Lumpur before 1948 (Kow, 1978).

This change was evident in the development that took place both within the town limits and beyond. Internal growth took several forms, one of these being ribbon development which reached out in all directions, taking in rubber estates and abandoned mining land. Another was suburban development associated with the movement of people from the centre to the periphery, a process already common in the urban centres of the industrial countries. Between 1931 - 1957 the built up area within the town boundary expanded from eighteen to thirty six square miles and the population increased from 111,418 to 316,230 (Sendut, 1965).

The nucleus of the central area of Kuala Lumpur coincides with the "Old Town" constructed before 1884 and is defined by the area reserved for the railway and bus terminal and the central market. According to the 1957 census, the density in the central area ranged from 110.8 to 217.4 persons per acre, whereas the density in the fringe was much lower. Development of the central area has been a continuous process of internal reorganisation of land use, overspilling towards the peripheral area of Kuala Lumpur. The reorganisation of the central area has gradually replaced residential shophouses with commercial establishments and streamlined a seemingly unorganised land use pattern. However, this reorganisation has been hampered by existing road systems, which are basically as they were in 1895. Traffic congestion in the city centre is a serious problem, only slightly ameliorated by the construction of inner and outer ring roads.

In 1974, the Federal Capital was enlarged to 94 square miles, henceforth to be known as the Federal Territory. The expansion of the size of the urban area inevitably contributed to the increase in the population of the city. This resulted in a high percentage of its area being converted into land for housing. Between 1975-1979 the area devoted to housing increased by 8% (DBKL, 1979). In 1985, housing made up 26% of the built up area of the city. Residential areas spread outward from the edge of the central commercial area in all directions. In most cases, however, they followed the major radial roads to the very edge of the Federal Territory, often leap frogging with other types of activities such as industry, and land for government agencies and institutions (Figure 2.4).

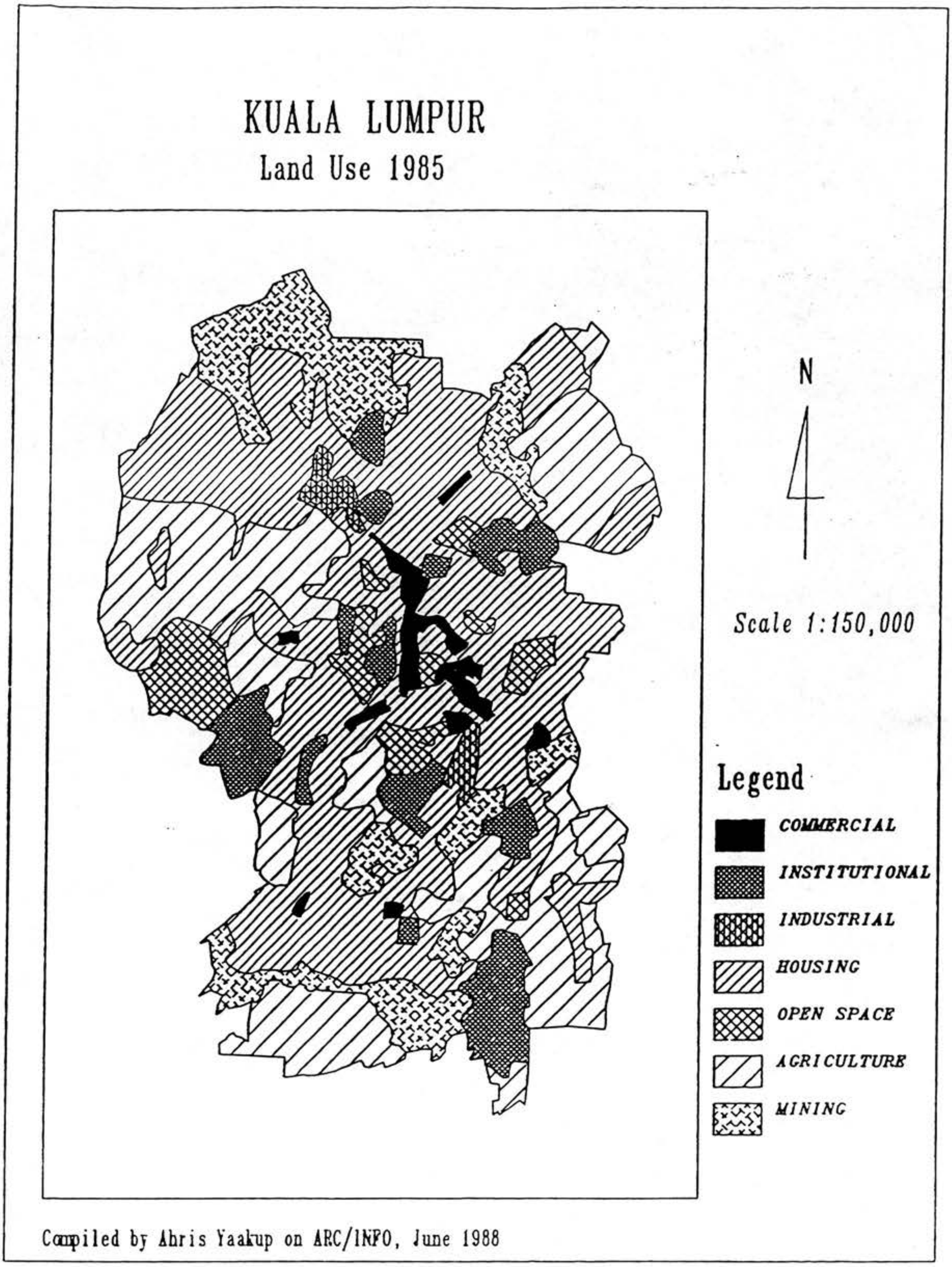


Figure 2.4: Land Use of Kuala Lumpur (1985)

Source: Department of Urban Planning and Building Control, Dewan Bandaraya Kuala Lumpur, 1985.

The expansion of development areas encroached upon the agricultural land. Between 1975-1979 both agricultural and ex-mining land were reduced by 6.2% and 1.2% respectively (DBKL, 1979). However, the remaining agricultural, vacant and ex-mining land still forms a considerable portion of the total i.e. 38% of the urban land use in 1985. Looking at the present trend of development, these areas can hardly be expected to remain unexploited for long (Figure 2.4).

Another significant effect of the expansion of the built up area is changes in the pattern of land values. Land values in Kuala Lumpur fall into a pattern which comprises a series of asymmetrical bands in the centre and broader grouping of values towards the periphery. Values are highest in the centre and diminish towards the periphery (Figure 2.5). This pattern indicates that land values in Kuala Lumpur are very much a function of location, that is, of proximity to the centre in addition to speculation and land use zoning.

When the pattern of land values and the existing land use pattern are compared with one another, a marked correlation between the two is noticeable. The land use pattern shows a pronounced commercial core surrounded by a variety of other uses which are predominantly residential. Commercial uses tend therefore to be associated with the highest land value while land under residential use

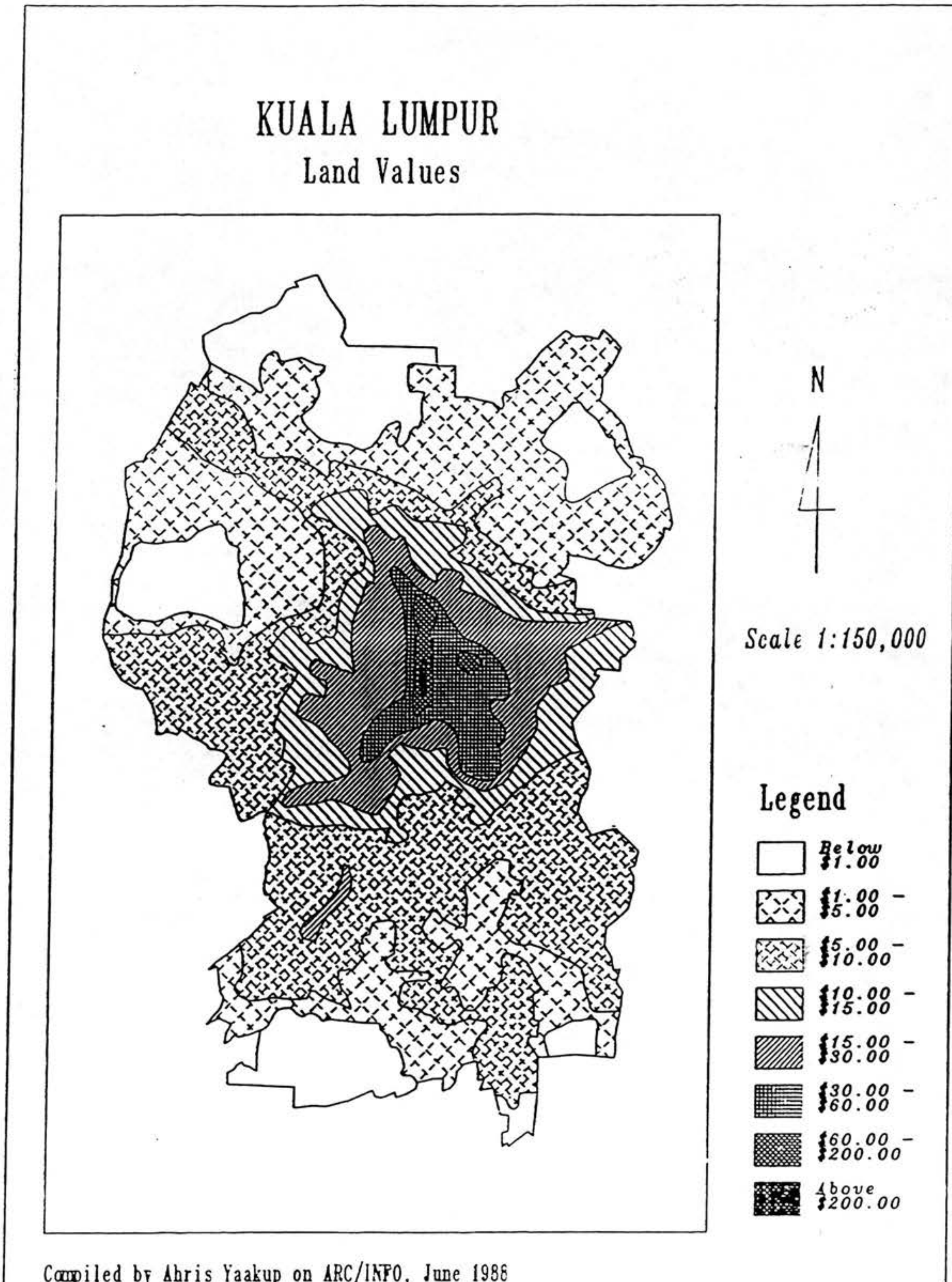


Figure 2.5: Kuala Lumpur: Land Values, 1985

Source: Urban Development Authority and Dewan Bandaraya Kuala Lumpur, 1985.

possesses varying value depending on location and the nature of development.

As land prices continue to spiral, people are forced to move outward and thus ribbon development began to develop along the major radial roads. Around the mid 20th century, suburban residential and shopping areas began to be established around the fringes of Kuala Lumpur, notably Petaling Jaya, followed by the more recent satellite townships. The gradual decentralisation of the urban centres, and amalgamation of resettlement villages with secondary centres linked to the central areas, transformed Kuala Lumpur and its immediate environs into an extensive urbanised region by the mid-70's.

The last decade has seen very intense construction activities, resulting in a dramatic change in urban form and design, especially within the city centre. However, there are still valuable pieces of land left undeveloped, resulting in an incongruous mix of modern buildings surrounded by undeveloped land and dilapidated structures. Such sporadic developments have unfortunately resulted in an almost incoherent mix of forms, function and activities.

2.5 Urbanisation Problems in Kuala Lumpur

As a result of rapid rural-urban migration, a number of socio-economic and environmental problems in keeping pace with demand for services, housing, urban transport and other amenities have arisen. These problems are further aggravated by the trend towards "primate city" status.

As the primate city of the country, Kuala Lumpur faces perhaps the most serious problems of urban poverty as compared with other urban centres. Being the political and administrative capital as well as the economic, commercial and cultural centre, Kuala Lumpur has a special attraction for people throughout the whole nation. It attracts not only rural migrants who have high expectation of bettering themselves in the city, but also migrants from smaller towns. This has resulted in an increase in the population of Kuala Lumpur municipal areas from 316,000 in 1957 to 485,000 in the 1970's (Mukzani and Khoo, 1977). Kuala Lumpur has thus become one of the fastest growing cities in Asia, with a growth rate of 7.8% per annum - 2.8% being natural organic growth and about 5% growth being the result of exogenous factors i.e., rural-urban migration.

The Kuala Lumpur Structure Plan (1984) estimated the number of residents in Kuala Lumpur in 1980 to be 1,036,900. It was forecast that the population would be about 1,550,000 in 1990 and 2,200,000 in 2000. The annual growth rate is expected to decline from 4.1% for the period 1980-1990 to 3.6% for 1990-2000. While the rate of natural increase may decline slightly from 2.2% to 1.9%

per annum, the net annual growth rate is expected to decline from 2.1% to 1.7% at the end of the forecast period.

The bulk of the migrants to the city are young people in the 20-35 age group constituting the more active segment of the labour force. They represent the main pool of skilled and trained manpower. In short they form the most valuable asset that the city possesses. The population forecasts for 1990 and 2000 estimate a gradual expansion of the 20-54 age group. The labour supply is thus expected to expand faster than the rest of the population. On the other hand, this group also exerts considerable pressure on accommodation and housing. Despite a declining migration rate, this group will therefore continue to exert this pressure as it matures.

2.6 Issues of Land and Housing for the Urban Poor

Housing is a basic need; in the context of Kuala Lumpur this goes beyond simply the need for shelter. It is a need for a decent home, an abode that one owns, preferably located in a congenial environment. The city has an existing stock of 188,000 houses of which 28% are classified as temporary and 12% as semi-permanent (DBKL, 1984). The temporary and semi-permanent houses are those with wall material made of wood and brick/timber respectively. Approximately 54% of all temporary and semi-permanent units are squatter houses. The housing need for 1980-1985 was estimated at 89,100 units. This total was meant to clear the then existing backlog, replace dilapidated units and to cater for the additional household needs. The total housing need between 1980 and 2000 is estimated to be an additional 326,300 units (DBKL, 1984).

The Fifth Malaysian Plan (1986-1990) emphasised the provision of housing as an important component of the programme to eradicate poverty (Government of Malaysia, 1986). Nevertheless, housing (legal) is still beyond the means and reach of the majority of the population. Housing still therefore presents the greatest challenge in the years ahead.

At present, the supply of housing in Kuala Lumpur has not been able to cope with the increasing needs. The 1980 housing backlog was mainly attributed to limited construction capacity, higher development costs, the difficulty in getting approval for land conversion, scarcity of land, shortage of building material and lack of construction manpower. These reasons are also cited as contributing to the high rate of price increases in recent years. It should be pointed out however, that the rate of increase in housing prices seems to be higher than the rate of increase in building and development costs (DBKL, 1984).

The demand for houses from existing owners and absentee landlords for investment and speculation purposes also contributed to the current price spiral. As a consequence of the 1980's price rises, approximately 60% of households are effectively priced out of the market (DBKL, 1984). Housing affordability, especially at the lower end of the income spectrum is weakening, thus widening the housing affordability gap between the rich and those of lower income groups. Therefore any housing provision programme has to take into account the affordability level.

2.6.1 Low Income Housing

In the past, the supply of low-cost houses from both the public and private sector was grossly inadequate to meet the need, and it thereby contributed to a growing backlog of housing provision. There is now an urgent need for the public sector to aim for a higher provision target. However, the public sector alone does not and will not have the capacity to satisfy all the demand for lower priced houses. Thus the role and contribution of the private sector towards achieving the annual target of lower priced houses is very crucial for attainment of the policy goal.

The private sector is more vigorous in its housing development activities than the public sector in Kuala Lumpur. However, as the housing policy does not clearly state its requirement from private developers, it is obvious that the allocation of houses to the public by the private sector is mainly based on economic factors rather than in line with the goals of the Government's New Economic Policy (Osman and Taib, 1980).

It has been suggested (Hai, 1976) that the lack of interest among the private developers in constructing low-cost houses is attributable to the high standard required by building regulations. The prevailing standards for preparing layout plans for residential areas and industrial and commercial concerns, as well as the architectural by-laws governing room size, ceiling heights and materials, do not allow for maximum utilisation of space. The standards allow usage of below 40% to 50% of the land area for building purposes and living area, the rest being taken up by roads, drains, schools, open space and other reserves for statutory uses, all of which require to be maintained at public expense.

This means that every developer is penalised by being deprived of up to 60% of the use of his land, which he has cleared, levelled and set out for construction at great expense. Only about 40% or at most 50% of the land is saleable, the rest of it has to be surrendered to the authorities for public use. The cost of preparing these areas has to be recovered in some way and this accounts for the higher prices of the houses.

Since the 1970's housing opportunities for low income urban dwellers have been decreasing rather than increasing in Kuala Lumpur. Evictions are on the increase and in the wake of a privatisation drive, the land and housing market has been deeply penetrated by large corporations and developers, diminishing the number of informal housing arrangements. The Malaysian government, increasingly aware of the difficulties involved in "innovative" approaches, is now concerned more with city-wide administration and management than with implementation of individual poverty-oriented schemes on a project-by-project basis. This means that in future housing problems will probably be tackled in accordance with the global goals for planning of the city.

2.6.2 The Urban Squatter Problem

It is commonly accepted that about one half of urban growth is the result of population increase within the urban settlements themselves and that most of the remainder is the result of migration from rural to urban areas (UNESCO/UNDP, 1977). Slums and squatter settlements grow in response to this ever-increasing number of people and it is both a popular perception and an academic assumption that most of the rural-urban migrants become squatters (Anthony, 1979).

As indicated earlier, increases in the price of houses have significant effects on the provision of low income housing. As a result, low income households have to pay substantially more than they can afford. The majority of lower income groups therefore have no other solution to their housing problem than squatting. The squatter labour force has been recognised as an indispensable source of manpower for the city's growing economy. However, because of their unplanned, insanitary and congested condition, squatter settlements are regarded as inappropriate in a modern setting, so a satisfactory solution to the problem of such settlements needs to be found.

A "squatter"(5) can be defined as "a person who settles on land especially public land without title; a person who takes unauthorised possession of unoccupied premises" (Allen, 1984). The illegal status of squatter settlements is frequently mentioned by United Nation's reports, one of which points out that:

> 'Improvised shanty town built on scrap material by squatters without tenure rights on land unsuitable for building have become the most notorious type of slum' (United Nations, 1974).

According to Abrams (1966, p.15), 'a squatter is one who settles on land of another without any legal authority'. So, we can say that squatting refers simply to the situation where a person has taken over land, a house or building and occupied it without lawful authority (McAuslan, 1986).

Two out of three squatters in Kuala Lumpur are from the lower income group earning between $200 - $500 a month (Osman, 1979). With this amount of income and a high dependency rate, many of them therefore have to live in poverty, and could not afford reasonably decent housing for shelter. A majority of them cannot afford to spend more than $40 - $60 per month on housing.

The majority of squatters in Malaysia occupy government or public land. In comparison the squatters in Kuala Lumpur seem to fare better than squatters in other developing countries. For instance, in Calcutta, squatters have to make their living alongside railroads, highways, under bridges or on any other land which is not under development. The poorest inhabitants are not even capable of squatting on a piece of land: 1987 estimates point to a maximum of 50,000 people living on the pavements of the city (Koelhof, 1980). In Bangkok, although "squatting" in terms of households illegally occupying land is not found on a very large scale, there are vast numbers of households in makeshift houses built on land with the landowners' permission but with only a temporary tenure. In 1975, there were more than one million people in such temporary housing with no security of tenure or with very short-term tenure agreements (McAuslan, 1986).

In Kuala Lumpur, the 1980 squatter population was estimated at 243,000 people comprising 48,700 households living in 40,900 dwelling units (DBKL, 1984). In relative terms there were 5.9 persons per dwelling unit, 4.9 persons per household and about 1.2 households per dwelling unit (the overall figures for Kuala Lumpur were respectively 5.5, 5.0 and 1.1). The squatter population grew at an average annual rate of 9.7% from 1974 to 1980. About 51.3% of the squatter population were under 20 years old and 26.3% were of school age. This suggests the need for facilities which can hardly be found in squatter settlements.

The total number of squatter settlements in 1980 in Kuala Lumpur was 177 (DBKL, 1984). They occupied approximately 7.3% (1771 hectares) of the total area of Kuala Lumpur. Of this land, 94.6% was government land (Figure 2.6). The mean density of squatter settlements was 22.5 dwellings per hectare. However some settlement contained as many as 89 dwellings per hectare. About 91% of all squatter dwellings had wooden walls. Out of the total number of squatter dwellings 19.4% were classified as "new" (built after 1980), 78.6% as "old" (built between 1965 and 1980) and 2.0% were in a dilapidated condition (built before 1965). Approximately 30% of the squatter dwellings had one bedroom, 32% had two bedrooms, 21% had three bedrooms and 17% had four or more bedrooms. The floor space per squatter dwelling ranged from 13 to 26 sq. metres with an average of 15 sq. metres. As regards ownership, about 76% of the squatter households were owner-occupiers, 19% were tenants and 5% were lodgers. In general, squatter

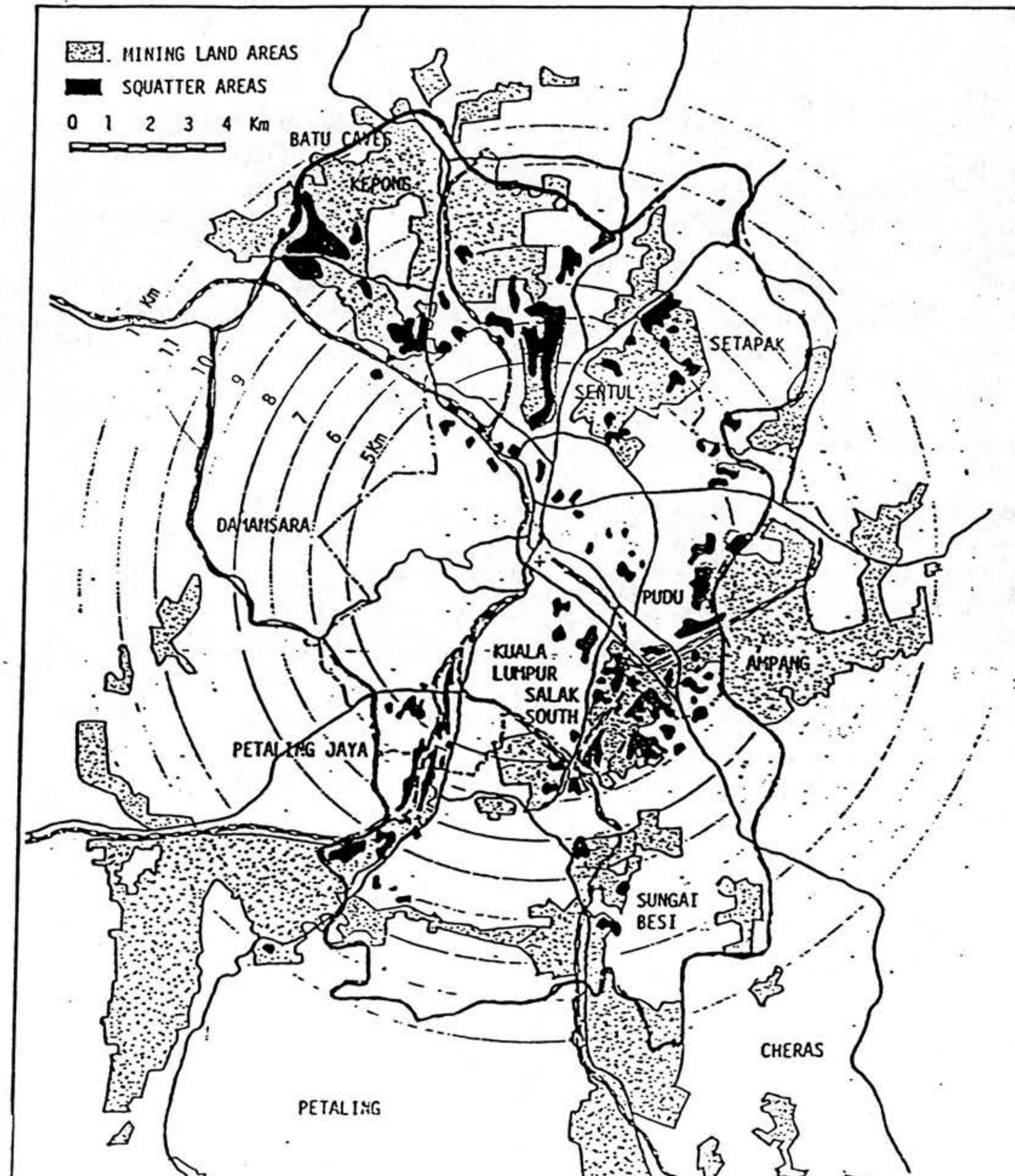


Figure 2.6: Location of Squatter Areas and Tin-mining Areas (1980)

Source: JICA (1981), The Reclamation Project of Ex-mining Land for Housing Development and Other Purposes, Government of Malaysia, Kuala Lumpur, Fig. 2-25.

settlements were lacking in amenities, facilities and basic infrastructures. Only about 6.5% of squatters had access to public standpipes, 9.7% had piped water within their dwellings, while the remainder had to rely on wells and river water.

In the 1960's, while lack of control of squatter 'invasions' was fairly general, the factor of greatest importance to poor people desperate for homes was land availability. Thus land being held vacant for speculative purposes, including individual inner city lots, was frequently at risk, though for tactical purposes, state land was usually preferred to private property by spontaneous settlers. Vacant sites close to factories or construction projects were especially valued because of the possibilities of employment. The most significant kind of available land, however, was that which has a very low value for most regular urban uses. Thus, spontaneous settlements were frequently located along river banks or on ex-mining lands.

The process of constructing squatter houses is often dangerous. Some of these people are forced to built their houses on sites which are not suitable for housing or detrimental to health. However, they have freedom to choose from several alternatives. As succinctly put by Turner (1976), by self-help, they have considerable freedom to live nearer to their priorities, families can keep their options and maximise their opportunities to gain future security.

Squatters often are the single most easily identified low income group in the city population, who need the help and support of the rest of the population in certain respects, but who perform a necessary role, and have a potential, but as yet unrealised, function in the society. The question is whether to demolish the squatter areas or to let them stay. To make that decision, a considerable awareness and appreciation of its implications is required.

There have been several aspects of squatter problems which have given rise to controversial issues among politicians, urban administrators, planners and society at large. The most debatable issues of all have been:

(i) Should the squatters be helped by the government to improve their livelihood in the cities or should their settlements be cleared or demolished?
(ii) If the government should help them what kind of help should be rendered, and what should the extent of that help be?

The squatter problems in Kuala Lumpur have also proved to be intricate political issues for the government to solve. To clear squatter areas would mean to lose favour with the squatters involved and also with part of the population in the country. Besides that, clearance of squatter areas can also trigger strong opposition and criticism from the general population, particularly from politicians of opposition parties.

Thus, the question of whether or not the squatters should be helped by government arises out of the nature and characteristics of the squatters themselves and the areas in which they live. It is common knowledge to all that squatter areas are sources of problems ranging from the social to those which are economic, physical and political in character. Such problems are also common to the squatter settlements of West Malaysia.

2.7 Urban Management Issues Related to the Squatter Problem

Despite the trappings of a capital city, Kuala Lumpur is physically an over-expanded small town. Recent development has resulted in changes of form with multi-storey complexes replacing the traditional shophouses. The last decade saw very rapid intense construction activities, resulting in a dramatic change in urban form and design. In the process there are also scattered developments in the outer areas. However, there are still valuable pieces of undeveloped land which give an incongruous mix of modern buildings surrounded by undeveloped land and dilapidated structures.

As regards the low income group in Kuala Lumpur, several diverse approaches to dealing with urban low income settlements and providing housing opportunities were adopted by the authority. During the 1950's and 1960's the Malaysian government "tolerated" or simply neglected the presence of "burgeoning squatter settlements" (Hosaka, 1987). In the 1970's some attempts to eliminate these settlement by mass eviction of residents and outright demolition of substandard structures were undertaken. Conversely, public housing projects were promoted to a limited extent, as providing "complete housing" for the people. It has been now clearly recognised, however, that these official housing projects largely failed to provide decent housing for the poorer section of urban residents. Several reasons were put forward for the failure. The authorities were unable to cope with the magnitude of demands, they involved huge amount of subsidies, standards were set too high and rigid, and dwelling units were sometimes located too far from the city centre or place of work. High rise flats constructed by government agencies often neglected the needs and life style of the people in the urban informal sector engaged in small business activities or home industries involving family labour. It was also not uncommon for former squatter dwellers in Kuala Lumpur, after they had been relocated from squatter areas and accommodated in public housing, to sell their tenancy rights to better off people and go back to being squatters.

Accordingly, housing policies in the 1970's promoted the site and services programme. It was assumed that people would be willing to invest in and improve their own houses once they were assured of security of tenure. It was recognised that in a considerable part of Kuala Lumpur, 25% of the housing stock was indeed constructed by the people themselves and made use of in order to accommodate the increasing population.

After a good deal of exaggerated optimism about the role of site and services in the 1970's, evidence from other parts of the world indicates that these schemes are unlikely to reach the poorest 30% of the urban population (World Bank, 1984). The experience of the only site and services programme in Kuala Lumpur has also confirmed similar drawbacks. Since the authority were unable to acquire large tracts of land in a more favourable location, the project was eventually forced to be located far from the work place. In addition, sites and services were found to be priced beyond the reach of the poorest group. At times, application procedures for obtaining new sites were cumbersome and time consuming for people who earned their living on a daily cash flow basis.

In order to ensure the continued growth of prosperity of Kuala Lumpur, it is important to maintain a constant supply of land with a sufficient choice of site available for low income dwellers. However, Kuala Lumpur has only a limited supply of land suitable for future housing developments, without incurring additional cost. The total land available for future development constitutes only about 4,000 hectares which have to be shared between various uses (DBKL, 1984).

The shortage of land is felt by the squatter settlements around the city fringe. The growing pressures on the built up area in the city are slowly pushing towards these squatter areas. As a result, the land values of the squatter settlements are on the increase. If areas are to be developed, their suitability, in terms of the best form of development, needs to be studied. Traditionally, in relation to land and housing for the urban poor, city planning failed to solve the problem because of lack of understanding and over ambitious policies for the poor and squatters. The system was found to be rigid and cumbersome. Policies were difficult to implement because of lack of public understanding and the public in return gave very little support towards the implementation of the project.

2.8 Conclusions

The most pressing urban problems are rapid urban growth, lack of public resources to provide accommodation and services for the urban poor, and the need for land, facilities and encouragement for those urban poor to create or upgrade their own accommodation.

In the past these problems were partly attributed to the lack of planning and inefficient management. An essential part of any improvement in the management process is comprehensive information on land and its related characteristics. This would be in line with a recommendation by the 1976 UN Conference on Human Settlement (Habitat) that comprehensive information on land capability, characteristics, tenure and legislation should be collected and constantly updated so that all citizens and levels of government can be guided as to the most beneficial land allocation and control measures. This can be used to guide improved approaches to planning and urban management.

Notes

1 All monetary values are, unless otherwise specified, in Malaysian ringgit (M$). Exchange rates in December 1991 were M$4.90 = UK£1.00.

2 An initial phase of urbanisation when 'the pre-civilised folk more or less share a common culture which remains the matrix for the urban culture which develops from it'. See Holelitz B.F., (1955) 'Generative and Parasite', Economic Development and Cultural Change, Vol.3, No.3.

3 Orthogenetic cities are those which carry forward into 'systematic and reflective dimensions of an old culture'. They are the cities of 'great tradition capable of translating the folk society into the urban world'. See Redfield R. and Singer M., (1954) 'The cultural role of the cities', Economic Development and Cultural Change, Vol.3, No.1, p. 53.

4 Based on the 1957 population census of the Federation of Malaya which classified as 'urban', all centres of over 1,000 inhabitants.

5 Many developing countries have developed their indigenous terms to describe the squatters and their colonies, some of which are; favelas (Brazil), raneros or conqueros and ranchos or ranchitos (Venezuela), paracaidistas or parachutists (Mexico) and geocekundu (Turkey). In Malaysia, squatter settlements have been popularly known as "setinggan".

CHAPTER 3

GEOGRAPHICAL INFORMATION SYSTEMS FOR URBAN PLANNING AND MANAGEMENT

3.1 Introduction

It is apparent that urbanisation problems are the main concerns in current town planning practice in Malaysia. Several issues, such as those described in the previous chapter, indicate the need for an effective urbanisation policy. At present, the Malaysian Five Year Plan has outlined the urban development strategy which serves to provide guidelines for development at local level. The plan also stressed the decentralisation of decision-making to regional and urban levels. The aim was for all levels to be involved in project formulation and decision-making as well as implementation. At the same time the Plan provides a framework within which strategic policy for development and change can be amplified and eventually implemented.

The aim of this chapter is to examine the nature of the planning system in Malaysia and compare it against the theoretical requirements of the "spirit and purpose of planning" (Bruton, 1984). This will form the background for the discussion of the role of Geographical Information Systems and how they can be utilised to enhance the practice of urban planning, with particular reference to the planning of squatter settlements.

3.2 Theoretical Aspects of the Planning Process

Since the publication of the Second Malaysia Plan in 1971 (SMP) the importance of developing a coherent regional and urban strategy as one way of promoting social and economic change has been an established Federal Government policy (Malaysian Government, 1971). In line with this policy, the philosophy and practice of town and regional planning in Malaysia have been reviewed and changes introduced through modifications to urban planning law. The resulting shift in town planning practice has been associated with changes in the theoretical perspectives of the discipline.

3.2.1 Planning as a Process

The idea of urban and regional planning in Malaysia is said to have originated from the planning concept first introduced in Britain, whereby planning is defined as "a process of human forethought and action based upon that forethought. It aims at the best use of land and greatest possible improvement in the human environment" (Chadwick, 1971, p.63).

This definition sees general planning as a procedure in which suitable schemes are designed at the outset and actions are based on the chosen schemes. Physical planning, on the other hand, is seen as referring to the "physical design or plan of some artifacts or buildings which might exist in the future" (Bruton and Nicolson, 1987, p.50).

According to Chadwick (1971), a plan is a general conceptual system. By creating a conceptual system independent of, but corresponding to, the real world system, we can seek to understand the phenomena of change, then anticipate them and finally evaluate them - to concern ourselves with the optimisation of the real world system by seeking optimisation of the conceptual system.

Clearly this requires the planner to understand the system involved before a plan can be drawn. As McLouglin (1969) points out, the preparation of alternative plans must be based on an understanding of how the urban system works, how it might evolve, how it develops if left alone, and how it would react to different policies. Invariably the activity of planning is more than producing plans and controlling development in accordance with these plans. The planning task embraces policy making and implementation which have a significant bearing on the spatial distribution of investment and the development and use of land at all scales.

3.2.2 Complexity and Uncertainty in the Planning Process

Changes in socio-economic as well as physical development are known to take a long time. Many factors should be taken into consideration to bring about changes since any one issue is often very complex (Pahl, 1970; Simie, 1974). In Malaysia, for example, at national level, attempts to deal with racial disharmony were related to, among other things, the distribution of economic activities, population, employment, and law and order. It is therefore ineffective to introduce social policy without having regard to the economic background. In the words of Mason and Mitroff (1981, p.4) '... every real world policy problem is related to every other real world problem and planning problems are no exception'. Acknowledgement of this situation is of vital importance to planners for it means that attempts to resolve a particular policy problem must consider the potential relationship between it and other policy problems.

Thus, policy-makers concerned with planning are faced with a range of problems which are inter-related in a most complex manner. The complexity, according to Simon (1962) is derived from the inter-relationships among the various elements in our organisations and the physical systems with which they interact. Chapin and Kaiser (1979, p.23) stress the point further and go on to say,

> '... because of the very tangible, complex and differential impacts of local decisions involving many persons and firms, what evolves is essentially

> an interactive progression of decisions rather than a single final decision on land use. Although practice varies from one locality to another,... in the land use planning process there is usually a recursive sequence in the way participatory, technical and political inputs to this process function to establish land use objectives, explore growth scenarios, test out development alternatives, and arrive at land use decisions'.

Another characteristic of planning which is very relevant is that "uncertainty characterizes all planning problems" (Christensen, 1985, p.66). Thus planners must assess the actual conditions of uncertainty that characterise the particular problem they are confronting and then select planning that suits those conditions. In short, if planning is to contribute to change in the environment a contingent approach must be adopted. However, there are dangers in moving entirely to a contingency approach, the most significant of which is that the objectives underpinning the overall strategy could be lost in the concern to adapt to complex and dynamic factors at the local level. What is required is an approach to planning which provides for a contingent approach, set within a strategic framework.

3.2.3 Strategic Planning, Contingency and Management of Change

The advantage of a strategic arrangement is that a comprehensive but generalised overview of issues can be established at the top level and developed into more detailed policies and eventual implementation at the lower levels (Ansoff, 1969; Simon, 1971). More recent developments in management theory have attempted to take account of the realities of planning and managing highly complex and multi-dimensional organisations and systems. The developments are generally referred to as the contingency approach to management (Newstrom, Reif and Monczka, 1975). They argued that methods and approaches appropriate to one situation will not necessarily be appropriate in another situation. Therefore, managers should be able to select the approach and course of action which is judged to be most appropriate at the time for dealing with specific issues within their particular context.

In public administration, the work of Friend and Jessop (1969) led to the view that planning is a continuous process of strategic choice. They suggested that the difficulties of dealing with current decision problems can be reduced by considering them within a wider strategic context, which embraces other related problems of present and future choice. Friend, Power and Yewlett (1974) and Hickling (1974) have taken this work further and developed a method of strategic choice and strategic control, which enables strategic policy to be formulated and implemented. The method accepts that such decisions are inter-connected, recognises a hierarchy of policy formulation and choice, and establishes an approach to decision-making which recognises the existence of uncertainty, while allowing complex problems and policy options to be pursued (Diamond, 1978).

Invariably strategic policies aimed at securing social and economic change involve some form of physical development. If this development is to be coordinated, it must 'be properly controlled and regulated' in a way which contributes to the achievement of socio-economic change while at the same time taking account of physical environmental factors.

In the light of some of the theoretical aspects of strategic planning, Bruton and Nicolson (1987) suggest an idealised conceptual framework for strategic planning and implementation in the public sector, as shown in Figure 3.1. This framework clearly demonstrates the area of concern for local planning and provides for a hierarchy of levels of decision-making, with the level above constraining the level below. It also gives the opportunity to define national social and economic objectives; and allows the coordination of the decisions and actions of a variety of agencies, concerned with the implementation of sectoral policies through a more detailed physical development plan and programming of resource allocation. Though the details of the structure will vary in application depending on particular circumstances and needs, the fundamental character of the various levels in the hierarchy is clear.

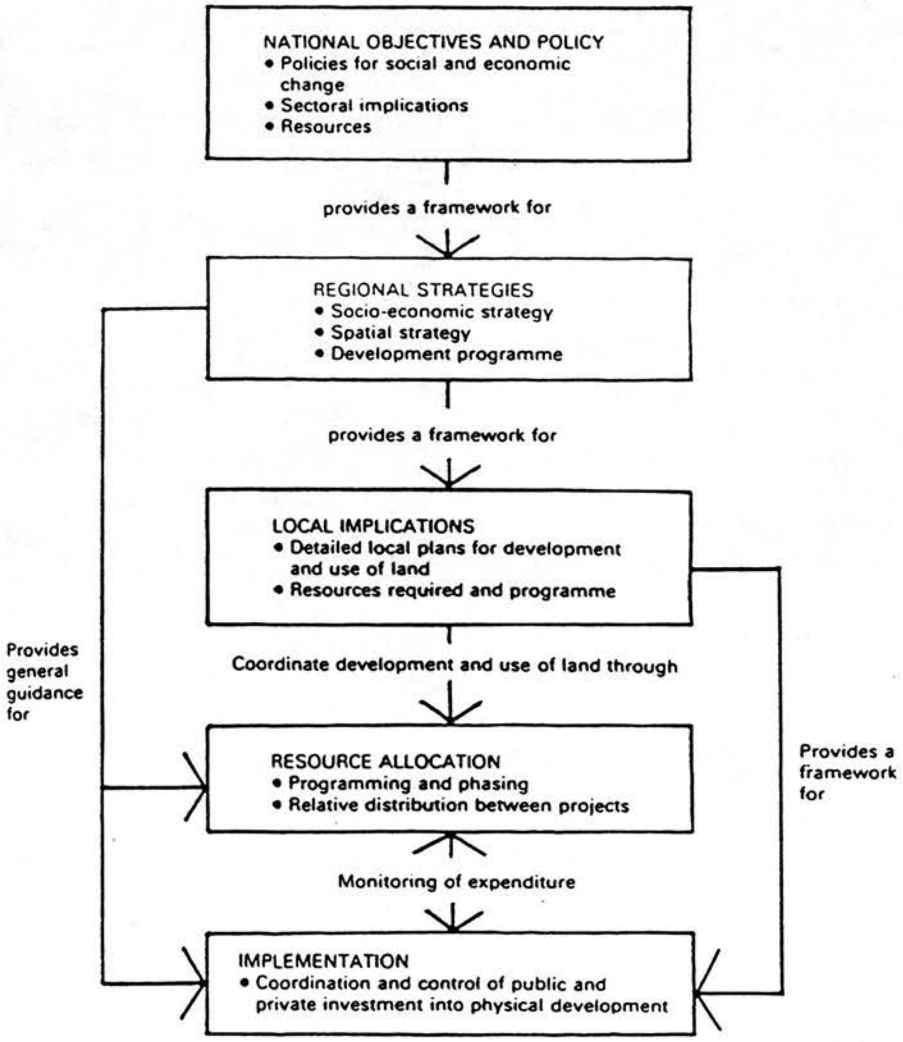


Figure 3.1: An Idealised framework for strategic planning and implementation in the public sector

Source: Bruton, M.J. and Nicolson, D.J. (1985) 'Strategic land use planning and the British development plan system', Town Planning Review, Vol. 56, No. 1, Figure 1.

3.3 Strategic Planning in Malaysia

A comparison of the Malaysian system of planning with the idealised framework shows quite clearly that at level one in the hierarchy i.e. "national objectives and policies", there is a close relationship between practice and theory. The New Economic Policy (NEP) (Prime Minister's Department, 1981) outlined at this level sets out the broad social and economic objectives adopted by the government, viz. to eradicate poverty and restructure society so that the association between race, employment and geographic location is removed. The national development plan produced since the formulation of NEP have been set quite clearly within the socio-economic framework established by NEP(1).

The situation at levels two and three in the hierarchy is, however, confused. Prior to the introduction of the Town and Country Planning Act 1976 (Act 172), level two, "strategic and spatial implications", was represented by regional economic planning studies(2). These studies were carried out for clearly defined regions or sub-regions, and produced policies which were translated into a physical strategy for the area covered. No satisfactory mechanism, however, existed until 1976 for linking the regional strategy to local detailed land use planning.

Again, prior to Act 172, level three in the hierarchy, "local spatial implications", were inadequately represented by the "general town plan" prepared under the Town Board Enactment CAP 137 (Federated Malay States, 1930). Given that prior to the implementation of the Local Government Act 1976, local government was spatially fragmented, so too was the coverage provided by the town plans. In addition, their limited and prescribed content and their inflexible form ensured that they were inadequate strategic planning tools for a country experiencing rapid change and development.

Thus, because of the areal fragmentation of the regional economic and town planning system, and the rigid nature of the general town plan, the planning framework which existed prior to 1976 was generally inadequate to meet the strategic planning needs of Malaysia.

3.3.1 The Town and Country Planning Act 1976

In 1976, the government passed the Malaysian Town and Country Planning Act 172 which aimed to introduce proper control and regulation of town and country planning in local authority areas in the states of Malaysia. The Act and its associated regulations (Federal Department of Town Planning, 1980) imply that the new development plan system established by the Act will provide the means whereby the level 2, "the strategic and spatial implications", and level 3, "local spatial implications", will be met in future. According to the Act, the state is responsible for general policy concerning the planning of the use and development of all lands and buildings, while the local authorities are concerned with regulating, planning and developing usable lands and buildings. This will be carried out by means of development plans.

Under Act 172 the Development Plan consists of two elements, (i) the Structure Plan i.e. a policy document requiring the approval of the state; and (ii) a more detailed Local Plan, produced on a map base and which can be adopted by the local authority. The Structure Plan consists of a written statement formulating the local authority's policy and general proposals for the development and use of land in its area. The Local Plan gives precise indication of the proposals put forward for the use of and/or development of specific sites; the improvement of the physical environment, improvement of communications and the management of traffic (Section 12(3)).

The role of the development plan in the Malaysian planning system is therefore quite clear. The Structure Plan is seen as a means of translating sectoral policies and programmes into spatial terms, while the Local Plan "fleshes out" the broad strategy for physical development in greater detail. Together they are expected to serve as a guide to developers and provide the basis for coordinating public and private investment in development.

It should be appreciated that the adoption of development plans coincides with the general acceptance of the new planning theories. Hitherto the accepted method of plan making was to survey the area, analyse its known or foreseeable problems, pressures and demands, and produce a plan which described a state of affairs expected or desired at some future date. The new theories adopted a continuous, cyclical systems approach based on the identification of needs, formulation of goals, the identification and evaluation of alternative courses of action and monitoring and readjustment of adopted programmes.

3.4 The Development Plan for Kuala Lumpur

Before 1984, Kuala Lumpur had a Master Plan consisting of the Central Area Development Plan, the Residential Density Zoning Plan and the Land Use Zoning Plan. These plans covered the Federal Capital area of 93 square kilometres (36 square miles). In 1974, the Federal Capital was enlarged to 243 square kilometres (94 square miles) and henceforth known as the Federal Territory. In the absence of a comprehensive development plan in the area outside the 93 square kilometres, development control had to be carried out on a piecemeal basis. It was apparent that such an approach was incapable of contributing positively to the achievement of the social and economic change sought by the Federal Government. Consequently, and with the changes to the city boundary mentioned above, the preparation of a new development plan was undertaken in accordance with the Federal Territory (Planning) Act 1982 (Act 267).

In 1984, the City Hall, being the local planning authority of Kuala Lumpur, completed the city structure plan. The main intention of the authority was to plan for a dynamic, efficient and pleasant city. Towards this end, City Hall formulated and adopted ten broad goals that underline the philosophy and direction of the structure plan. These goals form the basis for the definition of more objectives (Appendix B). The structure plan also outlined objectives, policies and programmes for individual sectors. One of the sectors tackled by the plan was squatters.

The Kuala Lumpur structure plan regards squatting as more than just a housing problem, and as such examines squatting from various perspectives, including housing, the environment, and socio-economic and administrative aspects. This is the most feasible approach, as it permits the development of comprehensive policies aimed at addressing and solving squatter problems. These policies are then crystallized into programmes and proposals.

3.5 Policies and Programmes for Squatters in Kuala Lumpur

Owing to the complexity and large scale of the problems, these programmes and proposals have to be divided into short-term (interim) and long-term perspectives. The short-term programme aims to reduce the current problems faced by the squatters, while at the same time removing obstacles to the objective of the long-term programmes, which is to ensure a Kuala Lumpur without squatters (DBKL, 1984).

3.5.1 The Overall Objective

It is the objective of the local authority to integrate squatters into the community of Kuala Lumpur. This overall objective can be broken down into a number of sub-objectives from which policies and proposals are formulated. These are:

1 Housing

- to provide legal and decent housing to all squatter households whether in the form of transitional long-houses or flats for rental;
- to encourage squatters who can afford to buy houses and move out of squatter areas;
- to eliminate squatter landlords.

2 Physical Environment

- to improve general amenities and facilities in squatter settlements;
- to plan and develop squatter areas into housing estates (or other suitable uses) so that they are in step with the development of the rest of the

city;

- to optimise the utilisation of squatter areas in terms of their potential and population carrying capacity.

3 Socio-economic aspects

- the socio-economic infrastructure of the squatters in established areas should be maintained wherever possible;

- the general economic conditions of the squatters especially those who live below the poverty line, should be improved;

- social services facilities and social development programmes aimed at the children and youth of squatter settlements should be maintained and intensified.

4 Administrative aspects

- to establish a squatter department to deal with all development problems relating to squatters;

- to monitor the movement of squatters and exercise control on the expansion of existing and formation of new squatter settlements;

- to improve co-ordination and streamline methods of channelling social and physical development programmes to squatter areas.

There are various ways in which houses may be provided. However, low-cost houses built in non-squatter areas are insufficient to cater for the existing backlog of demand. Therefore in the final analysis, the provision of housing to squatter households would entail the gradual development of squatter areas for housing. Only through this process could sufficient housing be made available to solve the housing problems of the squatters. As stressed earlier, the complexity and immensity of the problem will not permit the exercise to be undertaken within a short period of time. It is further anticipated that the provision of housing to squatter households will not only result in a heavy financial outlay but will also require technical, social, administrative and legal problems to be resolved. Therefore the authority proposals include the development of comprehensive programmes to provide houses to the squatters. These programmes will also form an integral part of the overall Federal Territory comprehensive housing programme (DBKL, 1984). Whenever possible, the houses will be located in the same area or nearest to the existing squatter settlements, so as not to disrupt the existing social infrastructure. The provision of housing for squatter households is to be carried out in an orderly and systematic fashion, with the highest priority being accorded to squatters whose houses are affected by government projects.

3.5.2 Interim Measures and Programmes

It is apparent that the process of housing provision and development of squatter areas will be slow. Therefore various interim measures and programmes have to be developed to make squatting and squatter settlements more tolerable. In this regard the authority proposed that a squatter improvement exercise should be carried out in areas not targeted for immediate development (DBKL, 1984). These interim programmes would generally be in the form of provision of facilities and amenities such as water standpipes, community halls and children's playgrounds, also there would be the possibility of improving main access roads to the settlements. Another form of improvement exercise would be the building of modular long-houses in vacant areas within the squatter settlement itself. Selected households could then be moved into these long-houses. The sites vacated by them could be developed for housing or other community uses. This measure, though unwieldly, as it requires a considerable input of administrative effort, would, however, help curb the incidence of squatting in the present areas of neglect.

3.5.3 The Squatter Department

The Kuala Lumpur Structure Plan realised the importance of monitoring the movement of squatters and the need to exercise control over the expansion and formation of new squatter settlements. Therefore the Structure Plan suggested that,

> 'The Authority should set up a permanent Squatter Department to deal with squatter related problems and to coordinate programmes for squatters' (DBKL, 1984, p.121).

The other functions of this agency were:

1) to maintain and up-date a squatter register;
2) to monitor the growth and expansion of squatter areas;
3) to liaise with all village committees so as to provide a satisfactory communication channel;

4) to coordinate all public and private agency programmes for squatters;

5) to enforce government directives e.g. to ensure that land vacated by squatters who have been resettled or given housing, is kept free from further squatting;

6) to develop programmes for orderly allocation of amenities and facilities;

7) to assist squatters in the purchase of legal housing.

In short the department was to be the management centre to aid in the monitoring of the implementation of the said plan. An essential requirement for it was to have an up-to-date and reliable information base about squatter developments. There was therefore a strong argument to establish an information system to help the department to carry out its task efficiently.

3.6 The Need for Information Systems for Strategic Planning

Since the activity of planning should be seen as a process (McLoughlin, 1969; Chadwick, 1971), plans cannot be made once and for all. The plan making procedure does, however, indicate that plan making may have to move in a direction that would substantially improve its ability to use information systems. This philosophy is based on the concept of feedback of information to evaluate plans and the plan making process (Geddes, 1939). In the plan making process Calkins (1972, p.78) suggested that, 'better planning will be achieved through better information, and better information will necessarily flow from an information system'.

In the U.K. this view was given official recognition by the Department of Environment in 1972. They stated that,

> 'An information system is part of the mechanism for reducing uncertainty in the knowledge and understanding of the (physical, social and economic) environment...'

The major functions required from an information system can be identified as follows:

i) The descriptive function - Information should help to describe a situation;

ii) The cognitive function - Information systems also contribute to improved understanding of urban and regional problems by providing the key factors and variables that can be analysed using urban and regional modelling and other statistical techniques;

iii) The normative function - The information system can also contribute to improved action by reducing the cost of actions with known consequences or by reducing uncertainty about the consequences of actions already taken or about to be taken. An example would be the impact of development proposals on squatters. This is discussed in detail in Chapter 7.

Realising the potential use of information systems, the first concrete move towards the creation of such a data bank in Malaysia was made in 1982, when the Centre for Policy Research, Universiti Sains Malaysia (USM) Penang, was commissioned to conduct a feasibility study on it. The National Integrated Data System (NIDAS) developed by USM was to demonstrate the technical and economic feasibility of constructing and integrating data systems, which could then be the prototype of a national integrated system for administrative planning and monitoring purposes (Lee, 1984). Consequently, the Klang Valley Regional Planning Information System (KEVIS) was established (Mat, 1987). As regards digital cartographic, as opposed to statistical information, the Survey Department under the Ministry of Land and Regional Development is in the process of developing a Computer Assisted Map System in the Fifth (1986-90) and Sixth Malaysian Plans (1991-95) (Mohammad, 1984).

However, much of planning has to do with the use of the land and how the different types of land use relate to one another. Spatially referenced data including parcel boundaries, buildings on site, and ownerships of land and buildings are a fundamental part of an information based approach to urban planning. This information combined with socio-economic data, such as census data or natural and environmental data, provides more meaningful information for planners and decision-makers.

3.6.1 Why GIS ?

A GIS provides the facilities to deal with the data requirements for the functions described above. An important GIS capability is in handling both digital catographic data and the associated databases of attribute information for map features (Healey, 1988). GIS systems can store the map-coordinates of point locations, linear and areal features. These features have attributes that must be stored in the database. Once all the data are stored, both the digital map and the database can be manipulated simultaneously. This is particularly important in many land use planning applications, which require data on a wide variety of physical and environmental attributes. For example, the CORINE system which collected a comprehensive database of environmental information for the EEC (Green et al., 1985; Wiggins et al., 1987), the Maryland Automated Geographical Information System (MAGI) (Marble et al., (eds.) 1984) which contains a mass of physical, cultural and area data for the State of Maryland and more recently the extensive BAKOSURTANAL National Topographic Digital Database, developed for the land resource evaluation and planning project for Indonesia (Rais and Suharto, 1990).

In urban areas many local authorities are beginning to develop their urban databases for planning and management (Campbell and Masser, 1992). These include the Brisbane City Council Digital Mapping System (Butler, 1989), the Burnaby Joint Utility Mapping Pilot Project (BJUMP) (Wiebe, 1986), development of the Capital Area Development Information System (CADIS) for the City of Baghdad (Dangermond and Sorensen, 1986) and the Geographic Information System for Urban Planning in Hongkong (Yeh, 1990).

Another main driving mechanism of any GIS is the ability to inter-relate data sets. Since the relative positions of different map features are known to the system, sophisticated analysis of relationships between features across geographical space can also be performed. The primary focus in the manipulation stage is the idea of overlay (this involves combining different maps to identify, for example, any areas having the necessary characteristics for a certain kind of development) and neighbourhood analysis. For example, overlay techniques have been used for selecting a new town site in Southern California, by combining components of a large regional database of the physical and cultural attributes of various sites (Dangermond, 1983). Another example in an urban area where GIS has been used, is in the analysis of potential densification sites for residential development in Enschede (de Bruijn and Sliuzas, 1985). In the field of project management, Geographic Project Monitoring (GPM) systems were designed for the Moneragala district of Sri Lanka (Yapa and Dilley, 1989).

A GIS is able to support all the stages of spatial data processing including manual or semi-automated digitizing, checking and editing of digitized data, edgematching of digital map files and output of information to a graphics device or hard copy plotter.

In planning analyses, information is derived from printed maps, field surveys, aerial photographs and satellite images. GIS systems enable data from a wide variety of sources to be integrated together in a common scheme of geographical referencing, thus providing up-to-date information (Grimshaw, 1988; Coulson and Bromley, 1990).

3.7 GIS for Urban Planning and Management

It has been argued that the introduction of GIS enhances the rationality of the decision-making process by improving data accuracy and accessibility and as a consequence leads to "better" decisions (Coulson and Bromley, 1990). Information is utilised to perform two sets of tasks in organisations. Firstly, information has a role in the process of deciding what actions to take, including both operational and strategic decision making and secondly, how the activities of an organisation are organised in terms of managerial control.

In planning, many of the strategic decisions have long-lasting effects. Thus, an important part of planning, must involve the evaluation of effects which are likely to be distant in time, in space, and in the affected functions. Fundamental to such a method of planning is the process of comparison, whether this is performed implicitly or explicitly (Teng, 1984). Thus, in formulating a programme it is necessary to compare actual progress with planned developments (for example in evaluating squatter policies as discussed in Chapters 8 and 9).

The fundamental approach to making long term plans, which are designed to avoid unintended consequences, is to ask "What-If" questions, although Harris has suggested a longer question than "What-If" that might read: "What would be the outcome of an appropriate set of assumptions and decisions if they were to become real and how desirable would the outcome be?" (Harris, 1990 p.24). This leads into one of the major difficulties of planning, whereby a large number of possible combinations of decisions are available (for example, when choosing suitable policy decisions for squatter settlements, various combinations of solutions can be tried out as discussed in Chapter 8).

To explore various alternatives for long term strategies, the planner must have a support system (including GIS) which permits him to try out a relatively large number of different alternatives. The GIS should accept hypothetical alternative inputs, estimate the consequences and produce maps and tabular outputs which summarise the effects of the assumed changes. The planner should be able to save, in electronic storage as well as hard copy, the results of these experiments for later comparison with the outcome of other experiments.

Given the dynamic nature of planning, it is particularly important to have a well-conceived planning management activity, which can serve as the eyes and ears of a large planning process. It provides monitoring and the surveillance of compliance with planning regulations and it serves as an early warning system with regard to sources of friction, imbalances, shortfalls and failures in the process of urban planning. Up-to-date and reliable information is therefore needed at municipality level to facilitate administrative procedures, policy planning and plan implementation. It is required for forecasting, modelling and evaluating the current situation and changes that are in progress.

Another reason for improvements being required is the quest for efficiency. The advent of corporate planning and the continued squeeze on local authority expenditure has led local authorities to examine critically whether service delivery is efficient and effective. This is one of the fastest developing area of policy planning within local government (Barret and Masters, 1985).

Consideration of the role of geographic information in improving decision-making focuses on the assumption that decision-makers act rationally. It has been suggested however, that the implementation of a GIS will be accompanied by an attempt to extend corporate activities and therefore have significant implications for the development of administrative practices within organisations (Campbell, 1991; Bardon, 1989; Danziger et al., 1982). For an effective implementation of GIS technology, the formulation of an overall management strategy based on the needs of users in the organisation is of utmost importance (Campbell, 1991).

3.8 Geographic Information Systems for the Kuala Lumpur Local Authority

Faced with rapid growth, there is constant pressure on City Hall to improve services while reducing costs, and to be more efficient and effective in its daily operations and management activities. Recognising the fact that 70% to 80% of the information and activities with which a local authority is concerned are location dependent (Somers, 1987; Butler, 1989), a Geographical Information System is required to address these problems. Land, for example, is the primary source of income; utilities, such as electric power distribution and sewers are spatially distributed; and services, such as schooling, hospitals, and economic development incentives are provided by defined geographic area. A GIS provides the tools to manage and use information concerning land and other phenomena which are geographically referenced.

3.8.1 A Conceptual Model for a City Hall GIS

Design of a City Hall information system should be based on an understanding of how municipal operations and planning are carried out. Municipal functions or tasks, and the types of data which support them, comprise the vital elements which tie together the various City Hall departments involved in operations and planning in Kuala Lumpur. The tasks and the supporting data will provide the fundamental framework upon which a conceptual model of geographic data entities and their relationships in Kuala Lumpur can be developed. City Hall comprises 5 main departments, each having several tasks. The basic tasks of these departments require the use of geographic data management procedures (e.g., storage, manipulation, analysis, retrieval and display). Figure 3.2 shows a very simple model for the City Hall GIS based on the formation of comprehensive and integrated data sets applicable to a wide range of municipal functions. The required GIS activities and needs of these departments show several areas of common interest including:

1) a centralised base map generation and maintenance function;
2) automated update of files from operational transactions;
3) access to a comprehensive database of parcel related data;
4) a commonly used parcel identification system;
5) access to a database of information concerning land development activities throughout the city;
6) a capability to analyse community facility service areas and site suitability;
7) a capability to process map data on the basis of variable sized user defined polygons;
8) the capability to produce thematic maps of numerous data sets.

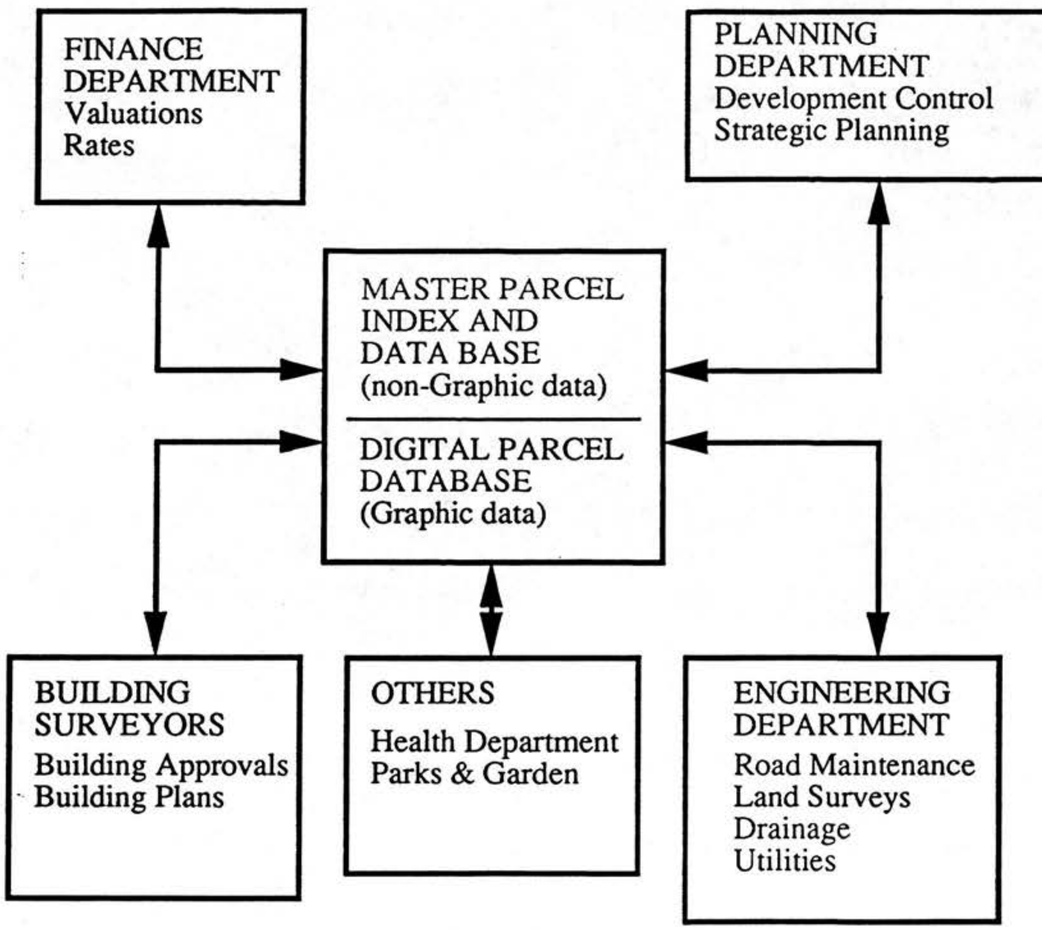


Figure 3.2 : Conceptual Model for the City Hall Geographic Information System

The conceptual model for GIS in Kuala Lumpur is based on the land parcel as the central entity in the GIS (Figure 3.3). The model represents the basic components of the City Hall in a manner that most easily translates into some of the newer technology involving relational databases and graphic information (maps) (Somers and Eichelberger, 1987). The components of this model include:

1 A Geographic Index - This provides the location and spatial relationships for geographic entities at the block level of geography. The Kuala Lumpur Planning Unit (established by the Kuala Lumpur Structure Plan) would serve as the geographic index;

2 The Cadastral Graphic and Land Record Database - This provides the location and spatial relationship information for geographic entities at the cadastral or parcel level of geography and the non-graphic information for the parcels e.g. lot number which would be used as a Unique Identifier for an individual parcel;

3 The Geodetic Control Database - This provides the geographic reference framework for the model. The data in this database is used to register new map data into the system and to improve the positional accuracy of existing data, when possible i.e. State Plane Coordinates will be used for this purpose;

4 Other related information including administrative, environmental, engineering and planning information.

The model therefore includes a geographic reference framework, the linkage of graphic and non-graphic parcel related data, the possibility of overlays and system access in both graphic (map related) and non-graphic (e.g., queries and text output) form. The model should also allow an integration of two levels of geography - the

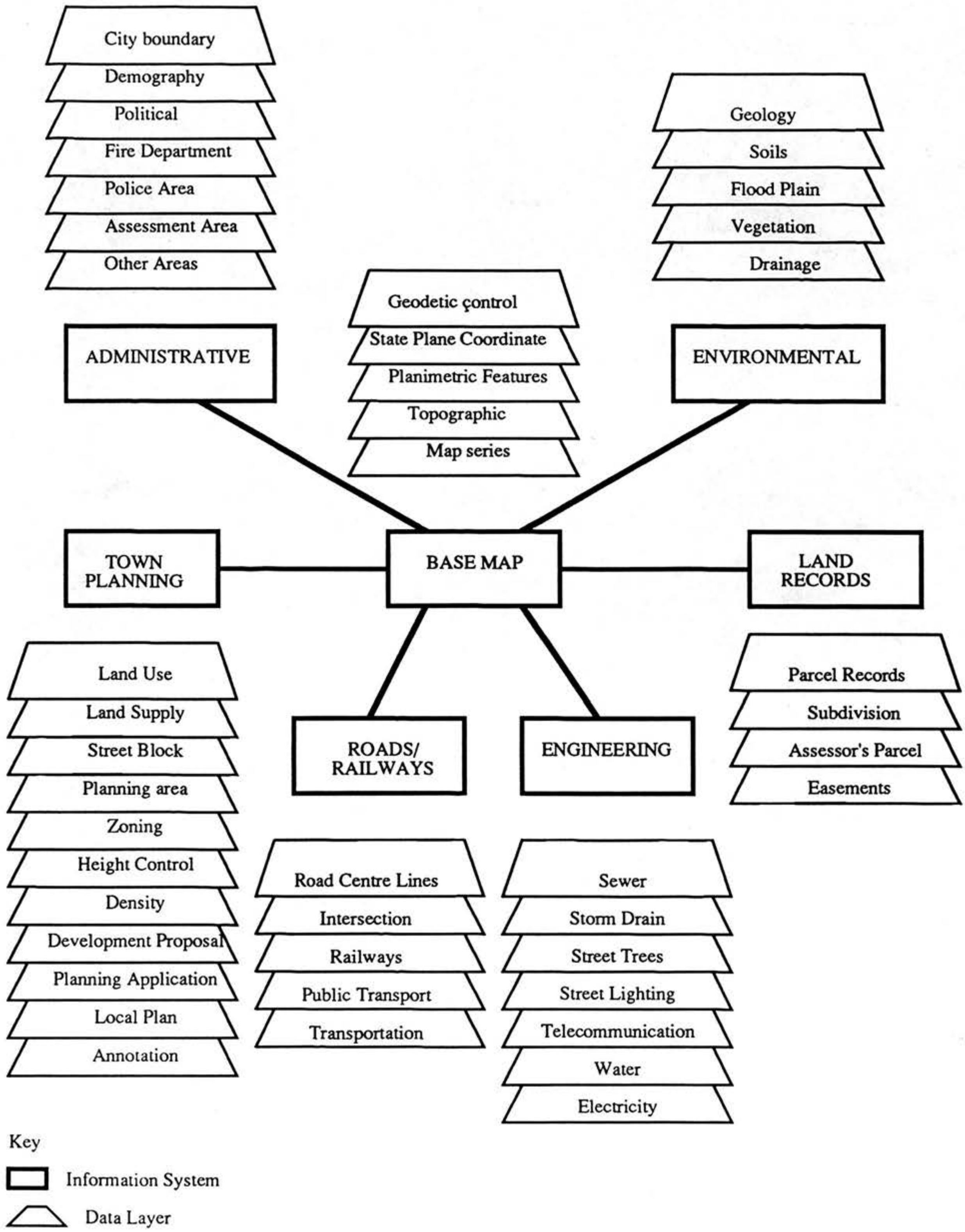


Figure 3.3 : Suggested Municipal Data Model for Kuala Lumpur

street network level (including data aggregation areas of block size) and the parcel/lot level. These linkages are accomplished by direct overlay of the graphic data or by linkages established within the GIS structure. Finally, this approach would allow a core of basic geographic/cartographic data to be established, with the flexibility to add new data or access the database in different ways, depending on application requirements. It would provide direct control of data that is required by a number of users, and a development approach that is based on information resource management.

To achieve the objectives of the conceptual model, the City Hall GIS would need to be developed through a structured process involving the specification of the organisation's requirements and the design of a system to best meet these requirements. Elements of this development process include: the determination of the intended users' functional and data requirements; examination and evaluation of existing systems and data sources; design of the GIS database; design of the GIS components, including software, hardware, and organisational requirements; development of cost-benefit analyses; development of an implementation plan; data collection and conversion; and the phasing in of the system implementation (Somers, 1987; Dangermond and Sorenson, 1986).

3.8.2 Strategy for Implementing City Hall GIS

The integrated spatial database approach usually requires new organisational structures to accomplish the development of a system that meets all user needs in an efficient manner. Even within the organisation or department, organisational changes may be necessary in order to implement and utilise GIS to its full advantage (Christie, 1985; Farthing, 1989; Chambers 1989). Existing organisation structures and operations were instituted and evolved in response to the manual methods of handling data. Such structures and operating procedures may not be the most effective for making use of the new automated data handling capabilities.

To be effective, geographical information systems unit should be set up as a separate unit (Figure 3.4). This unit would be responsible for implementing GIS and maintaining the database. The unit should include representatives from participating departments in the organisation. They should be working towards commonly agreed goals in setting up the unit.

It is suggested that the GIS developmental strategy in the City Hall should involve a phased approach. A comprehensive GIS established at once, at inter-departmental level, is hard to implement, as it is difficult to negotiate differences in data definitions and formats among the various departments. It is also

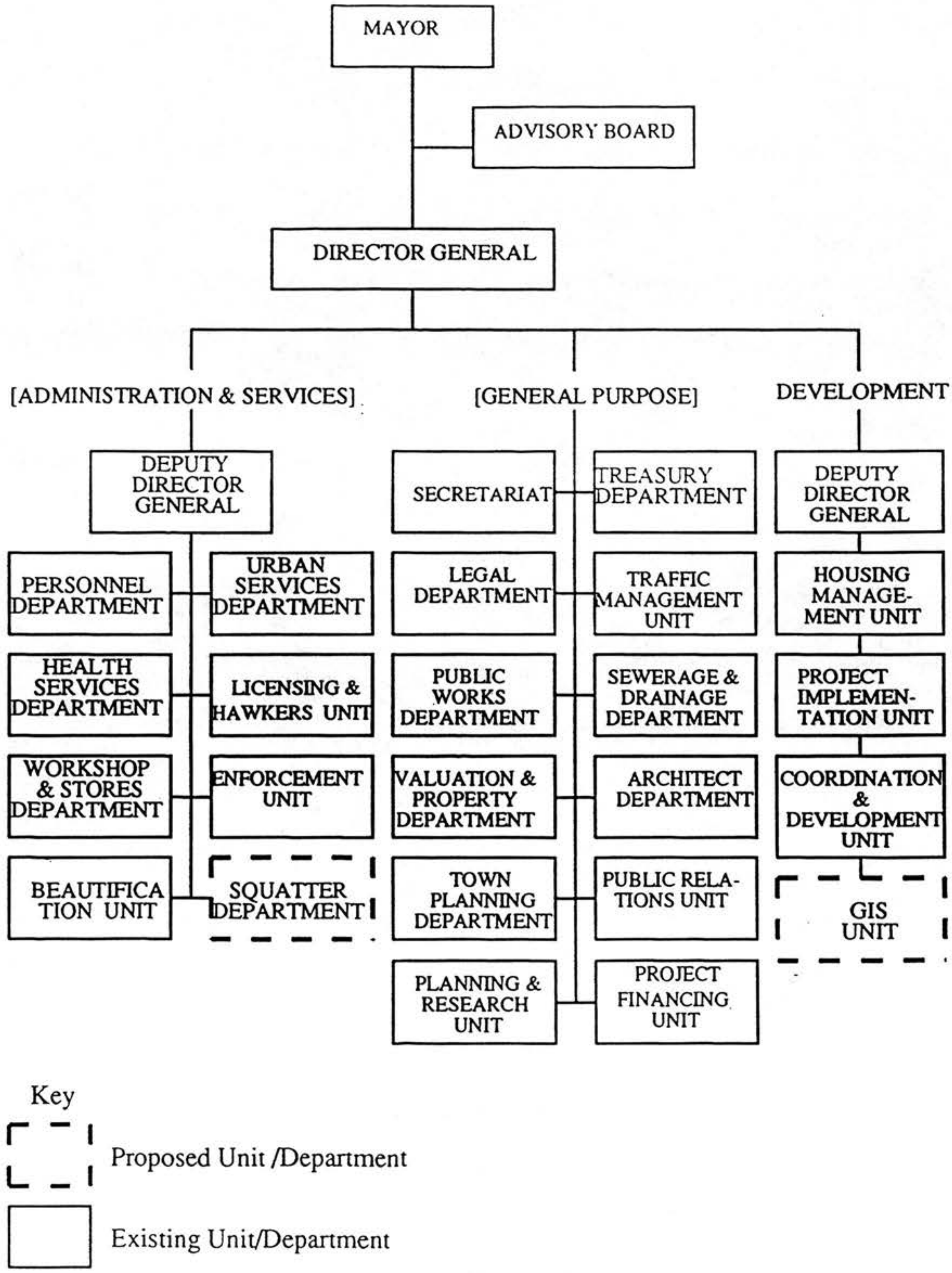


Figure 3.4 : Administrative Organisation of the City Hall of Kuala Lumpur

Source: JICA, (1981) The Reclaimation Project of Ex-mining Land for Housing Development and Other Purposes, Government of Malaysia, Kuala Lumpur, p.2-70.

difficult to find funding to finance such a large project, in which the technology is relatively new. An incremental approach is more pragmatic and realistic. This approach includes the provision of early deliverables, which are crucial to the developments as a means of maintaining user, political, and financial support. The creation of a full parcel level database is very time consuming, and may not show all the benefits for many years. During this development time it may be possible to implement simpler databases and system functions, such as geocoding based on street network and block data, thematic mapping, and basic computer aided drafting facilities. These initial moves help maintain project credibility, confidence and support during a long data creation timeframe.

At present the City Hall's Town Planning Department is working on a character-based database for city planning (Ali, 1989). It is suggested that the first stages of GIS implementation be linked to the development. The importance of GIS to town planning in City Hall is that eventually it would be reasonable to suggest that the City will have developed a geographical information system providing a complete City coverage of up-to-date and accurate information at the parcel level. These systems will include, inter alia, information on ownership, other legal interests in land, land use and development control data, land valuation and land sales. This information will be able to be manipulated, aggregated and displayed spatially, and combined with other socio-economic data.

Once the GIS for planning requirements has been developed, the system will provide a basis upon which a larger system can be built. Basic mapping that has been developed can be used as the integrator and coordinator of the system. Further development of the City Hall GIS depends very much on the willingness of other departments to integrate their data into the system. Detailed study is also needed to assess the future availability of funding and trained staff for the eventual implementation of the overall City Hall GIS.

Since GIS usually involve a sizeable investment, pilot projects should be used in various parts of the GIS development process. Pilot projects are used to evaluate database design, develop cost-benefit data, evaluate potential software and hardware products, and to evaluate planned operational processes (Somers, 1987; Aronoff, 1989; de Man, 1989; Dangermond, 1990). The case study of the GIS for the Jinjang/Kepong squatter settlement, to be examined in subsequent chapters, serves both as a pilot project for the application of GIS to this type of problem and also to the subsequent use of GIS as part of the development planning process in this context.

3.8.3 Use of the City Hall GIS: The Case of Squatter Planning

In the case of squatter planning, the municipal GIS unit must eventually provide general information, on the behaviour of people, households and enterprises in squatter areas - as needed to formulate behavioural models. The information needed at this level also includes a description of the state of the city, with respect to all the attributes which are relevant to judging the progress of plans and predicting the effects of future changes and needs. This description will be established at one point in time and kept current by updating from operational information. For the purpose of formulating strategies for addessing squatter related issues, the system should aim at measuring the incidence of squatter problems, such as the number of squatters and location of squatter areas. These allow the accurate identification and delineation of problem areas and the formulation of programmes of action aimed at ameliorating the situation in these areas. At this level, aggregate data are more useful than individual items of information, thus providing the decision makers with general overview scenarios. Within any squatter area, the municipal GIS should organise information on squatters at city block level. It is this level at which work on the pilot study is concentrated here.

As regards operation, the squatter department should collect and provide up-to-date information to be incorporated into the system by the GIS unit. The squatter department should also have access to other municipal information (e.g. town planning information) to review their policy on squatters on a regular basis for more effective control of squatter development.

3.9 Conclusions

This chapter has reviewed the needs of town and country planning with special emphasis on the inherent complexity of the many problems which need to be resolved, their spatial nature, and the requirement which they pose for answering "what-if?" questions. It has been argued that planning in Malaysia should conserve scarce resources and improve the effectiveness of development of facilities and services in the cities. Comprehensive methods with computer support should be used to pursue these goals effectively, while avoiding as far as possible any unintended consequences of planning decisions.

The introduction of GIS based methods gives planners a tool for a more systematic approach, based on spatial analysis of observed trends and the generation and comparison of alternative scenarios for future development. The use of GIS will make it possible to explore and assess more alternatives and present planning proposals with better quantitative backing. Taking into consideration the developmental and organisational aspects of implementing GIS at municipality level, the scope for improvement in city planning and monitoring of the effects of development is greatly increased.

Notes

1 The national development plans produced since the formulation of NEP are Second Malaysia Plan 1971-75, Third Malaysia Plan 1976-80, Fourth Malaysia Plan 1981-85, Fifth Malaysia Plan 1986-90 and Sixth Malaysian Plan 1991-1995. These national plans have been concerned to establish targets, and policies to achieve those targets, on both a sectoral and regional basis. They have also allocated the finance needed for implementation on the same basis. In addition, the broad regional and urban strategies are presented within a similar framework.

2 Examples of Regional Studies include the Penang Master Plan (Nathan Associates, 1970), the Klang Valley Regional Planning and Development Study (Shakland Cox and Partners, 1974), the Kedah-Perlis Development Study (Economic Consultant Ltd., 1974). These studies appear to meet the idealised requirement of level 2 in the hierarchy in two ways. Firstly, they set out the way in which national policies relating to both sectoral and regional development will affect major regions of the country. Secondly, they amplify sectoral policies and identify the broad spatial strategy which will coordinate investment into physical development. Despite these strengths, these studies have several shortcomings. They are ad hoc and have no statutory basis; no authority is made directly responsible for implementing the proposals put forward by the studies; and no resource allocation mechanism is established to coordinate the proposed development.

CHAPTER 4

GIS CONCEPTS AND DEFINITION

4.1 Introduction

The discussion in Chapter 3 emphasises the prevailing complexity and uncertainty in squatter planning. In this situation, decision makers have to make decisions that require knowledge about the condition of the squatters. To obtain this knowledge, relevant information has to be collected and recorded. Problems of storage, retrieval, manipulation, and analysis of vast quantities of spatial and attribute data can be major obstacles to achieving this aim. The emergence of geographic information systems over the last two decades offers a solution to these problems by providing tools for handling and analysing both spatial and attribute data.

It is the aim of this chapter to review the various theoretical perspectives which contribute to an understanding of geographical information systems and which provide a framework within which the planning and monitoring of squatter settlements can be undertaken more effectively.

4.2 The Nature of Geographical Data

Geographic data consists of groups of points, lines and areas together with their associated attributes positioned with reference to a common coordinate system. In a computer based GIS, the storage and presentation of geographical data are separate functions. The data may be stored in a high level of detail and then plotted at a more general level and at different scale.

Geographic data has a number of components which make it distinct from one dimensional data handled by other type of information systems (Peuquet, 1984b; Aronoff, 1989). They are:

i) Geographic Position

Each feature has a location and must be specified in a unique way, i.e. in terms of a coordinate system like the Latitude/Longtitude, UTM (Universal Transverse Mercator) or State Plane Coordinate systems;

ii) Attributes

An attribute may be defined as a quality, feature or characteristic of an entity. For example the squatter phenomenon being reported in terms of housing condition, household income, place of work, etc. These attributes are often termed non-spatial attributes, in that they do not themselves represent locational information;

iii) Data Relationships

Between the different type of spatial objects a large number of relationships may exist, for example, a simple one-to-many relationship exists between land parcel and land use. For a computer-based GIS, relationships must be expressed in a computer compatible manner;

iv) Time

The time component is not stated explicitly but is often critical, for example, in studying the growth and development of a squatter area. Geographical information describes a squatter settlement in a given location as it existed at a specific point in time;

v) Data Volume and Diversity

Geographic data ia also characterised by its occurence in large quantity and diversity (Peuquet, 1984b; Chorley, 1988). It is therefore, typical for a GIS to store diverse and large volume of data efficiently and in a permanent manner (Frank, 1984).

Taken together these characteristics make geographic data particularly difficult to handle. It is too complex to record all the information for geographic entities. The database system of a GIS provides the means of organising the spatial and non-spatial attribute data for efficient storage, retrieval, and analysis.

4.3 What is a GIS ?

Taken in its broadest sense, 'a geographical information system is any manual or computer based set of procedures' (Aronoff, 1989, p.39), used to store and manipulate geographically referenced data. Like all information systems its function is to improve the ability of a user to make decisions in areas of research, planning and management. It involves a chain of steps from observation and collection of data, to analysis and the production of information useful in some decision making process.

The term GIS was first used in the Canada Geographical Information System in the early 1960's (Tomlinson et al., 1976) but widespread use of the technology did not take place until the 1980's. GIS can be seen as a part of the development of computer technology in the areas of database management, graphics and digital mapping. It falls under the general heading of "information system" as defined by Lucas (1978, p.5) to be,

> '.... a set of organised procedures which, when executed, provide information to support decision making'.

Such a system may be conceived of, in a simple terms, as a framework by which to ask questions and obtain answers from the data resources. These objectives are shared by those information systems which are peculiarly geographic, and hence, a GIS can be considered as one instance of a more generic class of systems.

Goodchild (1985, p.328) defines a GIS as,

> '.... a system which uses a spatial database to provide answer to queries of a geographical nature',

He continues, that,

> '.....since putting spatial data into a computer at great expense for the sole purpose of getting it out again would be pointless, a GIS must allow a variety of manipulation to be carried out such as sorting, selective retrieval, calculating and spatial modelling. We also expect a full range of functions to allow input of data in map form and cartographic output'.

In similar tone, Tomlinson (1987) states that,

> 'A GIS is a digital system for the analysis and manipulation of a full range of geographic data, with associated systems for inputting such data and for displaying the output of any analysis and manipulation'.

As such, a GIS can be said to be a method of capturing, storing, retrieving and analysing data which is held in a structured form, has locational identifiers and can therefore be manipulated and mapped in a variety of ways. When the processing of its data is achieved by digital methods, a GIS is considered to be automated (Aalder, 1980).

Summarising, the most commonly accepted and reflected definition of GIS is the one used by the National Science Foundation (NSF), i.e., 'a computerised database management system for capture, storage, retrieval, analysing and display of spatial data or information defined by its location' (Taylor, 1989, p.24).

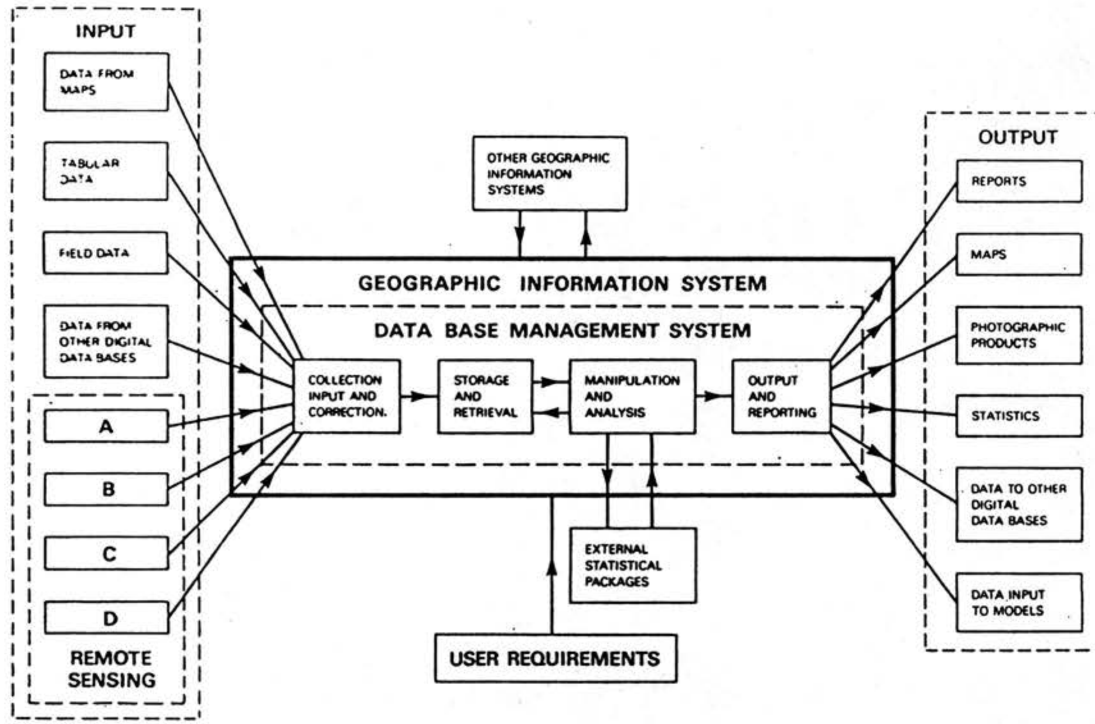


Figure 4.1: Principal components and functions of idealised Geographical Information Systems for Urban and Regional Planning

Source: Young, J.A.T. (1986) A UK Geographic Information System for Environmental Monitoring, Resource planning & Management Capable of Intergrating & Using Satellite Remotely Sensed Data, Remote Sensing Society, Monograph No 1, Nottingham, p.5.

Such information systems are made up of a number of inter-related subsystems each of which exists to perform a specific task. The primary subsystems in a GIS are those involved in (a) input or collection; (b) storage and retrieval; (c) output or reporting of data. In addition, a GIS may call upon "external" packages to assist any of its subsystems and operations. It should also be possible for data to be transferred rapidly between databases held on different computers, and for one GIS to communicate with and benefit from the capabilities of others. There is thus a multiple flow of information in GIS. These functions are summarised in Figure 4.1.

4.3.1 Modelling Geographical Data

In simple terms a data model is a general description of specific sets of entities and the relationships between them. Therefore a data model is concerned with sub-dividing a portion of reality until the entities, relationships and attributes are identifiable and understood within the context of a database (Howe, 1986). By using the process of abstraction the modeller can represent an intermediate view of data, between the reality which relates to the phenomenon as it actually exists in the world, and the database which represent how the data is viewed by the computer.

A geographical data model will in general, have four elements (Peuquet, 1984b):

i) the various types of spatial entity i.e. points, lines and polygons;

ii) the descriptive attributes for each of the entity types;

iii) the geometric descriptions of each entity type either using a "raster" or "vector" approach;

iv) the relationships between entities, which include topological relationships such as "consist of", "part of", and "bounded by", and relationships describing the class of objects comprising a given spatial entity.

These four components can be arranged in a variety of ways, but whatever the design, it should be recognised that no model can represent all aspects of reality. For example, one might attempt to include all identifiable entities and relationships, resulting in a more complex model which tends to be more robust and flexible in handling a number of applications. On the other hand, one might chose only to include those entities and relationships which are essential to the initial intended use (Bouille, 1978). In this case, the model will tend to be simpler and more efficient in terms of storage space and ease of use although it may be less versatile in terms of application and future developments. In practice, there has to be a trade-off between the two extreme approaches of geo-data modelling (Peuquet, 1984a).

4.3.2 Spatial Data Models

There are two fundamental approaches to representing the spatial component of GIS; the raster and the vector data models.

(i) The Raster Data Model

In the raster model, space is regularly subdivided into cells (usually square in shape). The location of geographic objects or conditions is defined by the row and column positions of the cells or pixels (picture elements) that cover their area. The value assigned to the cell indicates the value of the attribute it represents. Sets of square cells are easily handled by numerical arrays in standard programming languages. The raster data model is also easily interfaced to the hardware devices commonly used for the input and output of spatial data. One disadvantage, however is that raster files tend to be relatively large (Table 4.1), also many of the cells may contain the same value as neighbouring cells. Under these circumstances, significant reduction in the size of the raster files can sometimes be achieved using various methods of data compression such as (a) run length encoding, and (b) quadtrees.

(a) Run Length Encoding

In run length encoding, adjacent cells along a row that have the same value are treated as a group, termed a run. Instead of repeatedly storing the same value for each cell, the value is stored once, together with information about the size and location of the run. Run length encoding can significantly reduce the storage needed for a raster data file, but the trade off between cell size and file size still remains. The quadtree structure has been developed to address both the problems of resolution and the redundancy in recording attribute values.

(b) Quadtrees

The quadtree data model provides a more compact raster representation by using a variable sized grid cell. Instead of dividing the area into cells of one size, finer sub-divisions are used in those areas which have greater variability in the values for the attribute of interest. In this way, a higher level of resolution is provided only where it is needed. In implementing the concept of quadtree, several systems have been developed to assign identification or key numbers to the quadtree nodes. The Morton matrix number is perhaps the most widely known because it is convenient for computer implementation (see Peuquet, 1984a; Abel, 1984; Samet, 1984; Samet et al., 1986; Hogg et al., 1987).

The use of quadtrees can make certain spatial analysis functions (such as set operations and point in polygon searches) more efficient than when a conventional data structure is used. Quadtrees tend to have their greatest advantage when the data is relatively homogeneous, does not require frequent updating and when fast execution of certain types of functions is needed. Their advantages diminish as the map become more complex, as the data have to be updated more frequently (Waugh, 1986), and when types of analysis less suited to a quadtree structure are performed such as urban neighbourhood analysis (Aronoff, 1989).

(ii) The Vector Data Model

In the vector model, objects or areas in the real world are represented by the points and lines that define their boundaries, much as if they were being drawn on a map. It provides for the precise positioning of features in space. The map area is assumed to be a continuous coordinate space where a position can be defined as precisely as desired.

There are several vector data models used in GIS to represent line, point, polygon and terrain-based features:

(a) The Spaghetti Data Model

In the spaghetti data model, the paper map is translated line by line into a list of XY coordinates. A point is encoded as a single XY coordinate pair and a line as a string of XY coordinate pairs. An area is represented by a polygon and is recorded as a closed loop of XY coordinates that define its boundary. The common boundary between adjacent polygons must be recorded twice, once for each polygon. The term spaghetti model reflects the collection of coordinate strings with no inherent structure. Although all the spatial features are recorded, the spatial relationships between these features are not encoded. This information would have to be generated by searching all the features in the data file and calculating whether or not they were adjacent. The spaghetti model is very inefficient for most types of spatial analysis since any spatial relationships must be derived by computation. Since information extraneous to the map plotting process is not stored, it is, however, an efficient model for digital map reproduction (Peuquet, 1984b).

(b) The Arc-Node Model

An arc is a series of consecutive, non-intersecting line segments with common attributes and with no connection to any other link except at its start or end. It is represented in a digital map by one or more attribute codes, together with the "string" or list of coordinate pairs that make up each line segment. A node is the start or end of an arc; it can be shared by several arcs. The coordinates of the nodes can be listed in a separate file and can be cross referenced to any arc for which they form a start or end point.

(c) The Topological Model

Arcs and node structures also permit the handling of topological features. Topology is the mathematical method used to define spatial relationships. It is concerned with establishing the location of objects, identifiable by points, lines, polygons, and surfaces with respect to each other in a non-metric structure. It is thus concerned with connectivity, adjacency and containment (Dale and McLaughlin, 1988). The topological model is the most widely used method of encoding spatial relationships in a GIS. It is used in:

1) Network analysis, where the inclusion of sequences or connectivity of segments allows the selection of such details as shortest paths, or emergency access;
2) Neighbour relations, by knowing the neighbours of a given polygon such as a land parcel;
3) Overlay processing, where new polygons can be created from the overlaying of existing polygons, such as soils over land use.

(d) The Digital Terrain Model

Several data structures have been used to represent digital elevation data (Mark, 1979). However, the triangulated irregular network (see Peuker et al., 1978; Mark, 1978) is being widely used in commercial geographic information systems (Mark, 1986). The Triangular Irregular Network or TIN is a vector based topological data model that is used to represent terrain data. A TIN represents the terrain surface as a set of interconnected triangular facets. For each of the three vertices, the XY coordinate (geographic location) and the Z coordinate (elevation) values are encoded. Using a TIN model, terrain parameters like slope and aspect are calculated for each facet, and stored as an attribute of the facets in the same way as attributes are stored for polygons. These values can then be queried using the same type of database operations.

(iii) Comparison of Raster and Vector Data Models

The different approaches have their advantages and disadvantages. The major trade-offs are summarised in Table 4.1. Each approach tends to work best in situations where the spatial information is to be treated in a manner that closely matches the data model.

One of the advantages of the raster model is that data capture is rapid and can produce data in a form suitable for certain types of processing such as when determining the area of intersection between two polygons. Given raster data, it is only necessary to check whether any pixel is filled in both data sets, if it lies in the overlap area. Polygon overlay using vector data requires the computation of all points of intersection. Since each curved line is made up of short sections, this requires significant computational time. One disadvantage of raster data is that certain other types of processing

Comparison of Raster and Vector Data Models.

RASTER MODEL	VECTOR MODEL
Advantages:	**Advantages:**
1. It is a simple data structure.	1. It provides a more compact data structure than the raster model.
2. Overlay operations are easily and efficiently implemented.	2. It provides efficient encoding of topology, and, as a result, more efficient implementation of operations that require topological information, such as network analysis.
3. High spatial variability is efficiently represented in a raster format.	3. The vector model is better suited to supporting graphics that closely approximate hand-drawn maps.
4. The raster format is more or less required for efficient manipulation and enhancement of digital images.	
Disadvantages:	**Disadvantages:**
1. The raster data structure is less compact. Data compression techniques can often overcome this problem.	1. It is a more complex data structure than a simple raster.
2. Topological relationships are more difficult to represent.	2. Overlay operations are more difficult to implement.
3. The output of graphics is less aesthetically pleasing because boundaries tend to have a blocky appearance rather than the smooth lines of hand-drawn maps. This can be overcome by using a very large number of cells, but may result in unacceptably large files.	3. The representation of high spatial variability is inefficient.
	4. Manipulation and enhancement of digital images cannot be effectively done in the vector domain.

Table 4.1: Comparison of Raster and Vector Data Models

Souece: Aronoff, S. (1989) Geographical Information System: A Management Perspective, WDL Publication Ottawa, Canada, P.166.

(i.e. topological relationships) are more complex and the volume of data generated is very large. Vector data is less easy to capture using automated methods. The vector approach results in substantially less data being generated and for many operations this can be more easily handled than a raster base (Dale and McLoughlin, 1988; Aronoff, 1989).

4.3.3 The Database Approach in GIS

A second important component of GIS is the handling of attributes for digital map features. Over the years, GIS systems have developed by incorporating and adapting various information technologies to meet the needs and objectives of a particular community of data users. Prominent among these technologies is that of database management systems (DBMS). Database can be defined as,

> 'a collection of interrelated data stored together with controlled redundancy to serve one or more applications in an optimal fashion; the data are stored so that they are independent of programs which use the data; a common and controlled approach is used in adding new data and modifying and retrieving existing data within the database' (Martin, 1982, p.4).

A database system is therefore, essentially nothing more than a 'computerised record keeping system' (Date, 1986, p.3); a system which maintains information and which makes that information available on demand to legitimate users. As DBMS have evolved and developed, so their potential utility in the GIS environment has increased.

Over the past three decades, a considerable body of theory and practical experience has been developed in handling non-spatial data. The development of database systems to handle spatial information and associated attribute data has been more recent, mainly within the past ten years (Aronoff, 1989).

Two of the major factors which have led to the widespread adoption of DBMS in the design of GIS are the increasing scale of GIS operations in large organisations and the wide and expanding range of utilities that they can provide, many of which are useful for GIS operations as well as business applications.

Aronson (1987) describes five different stages of evolution in database structures which can be traced, with each successive development becoming more sophisticated in terms of data handling capabilities. These stages are:

(i) Tabular structure;

(ii) Hierarchical structure;

(iii) Network Structure;

(iv) Relational Structure;

(v) Object Oriented Structure.

However, the three most commonly used in generic DBMS are the hierarchical, the network and the relational structures (Ullman, 1982; Date, 1986; Everest, 1986; Pratt and Adamski, 1987). Recently the object oriented structure is starting to become available in commercial systems.

(i) Hierarchical Structure

Hierarchical databases are organised as ordered sets of trees. The relationships among the entities are defined by the organisation of the hierarchy. The organisation is encoded in the data record for each entity. The top of the hierarchy is termed the root. Except for the root, every element has one higher level related to it, termed its parent, and one or more subordinate elements, termed children. An element can have only one parent but can have multiple children. Data are retrieved by navigating the parent/child relationships and then working through the child nodes.

Within the context of GIS, this structure is suited to data which occur in a hierarchical form (Burrough, 1986) but it has not been widely employed in GIS for a number of reasons. Major disadvantages of the hierachical structure are that the relationships are difficult to modify and queries are restricted to traversing the existing hierarchy. The structure requires a large amount of storage space to load geographic data and data retrieval is not efficient (Burrough, 1986). Another limitation is that multiple parents are not allowed. There are many cases where an element needs to be represented as a member of multiple groups. Some of these restrictions are addressed by the network model.

(ii) The Network or CODASYL Approach

The network or CODASYL (Committee on Data Systems Languages) approach is based on the idea of explicit linkage between related entities (Martin, 1977; Date, 1986; Oxborrow, 1986). The network data structure overcomes some of the inflexibility of the hierarchical structure. In this approach, an entity can have multiple parents as well as multiple child and no root is required. As a result, data records can be directly searched without traversing the entire hierarchy above that record. Network models too have less redundant data storage than the corresponding hierarchical structure. However, more extensive linkage information must be stored, adding to the size and complexity of data files (Burrough, 1986; Aronoff, 1989). In a complex database, the linkage information can be substantial and considerable time may be needed to update the linkages.

(iii) The Relational Structure

The relational structure is based on the mathematical concepts of relations (relational algebra) and sets (set theory) and was introduced by E.F. Codd in the late 1960's (Codd, 1970). In the relational structure there is no hierarchy of data fields within a record, every data field can be used as a key. Date (1986) explains the model as one which is perceived by a user as a collection of two dimensional tables. (A table is characterised by rows and columns where each entry is an attribute value). Using the model, a search can be made of any single table using any of the attribute fields singly or together. Searches of related attributes that are stored in different tables can be done by linking two or more tables using any attribute they share in common. For example, the Structured Query Language (SQL) is a formal and non-procedural language for use with relational databases which is based on tuple-oriented relational calculus (Oxborrow, 1986; Martin, 1982; Date, 1986). This logical join operation gives the relational model tremendous flexibility. It is able to accommodate diverse queries for which it was not specifically designed. Its close association to Entity-Relationship modelling for database design is favoured by Chen (1976) and was applied to spatial data modelling by Tuori and Moon (1986). Indeed, flexibility has made the relational structure the most commonly used approach to the storage of attribute information in a GIS.

4.3.4 Managing Spatial and Attribute Data Simultaneously

Early systems for GIS and automated cartography used data files directly without using a database management system. Aronoff (1990) identifies 4 ways that DBMS concepts are applied in the context of GIS (also see Guptill, 1987; Charlwood et al., 1987):

i) The views of the data are independent of the way the data are stored;

ii) Automated updating of interrelated data files is provided;

iii) The relationships between the spatial and attribute data are explicitly defined;

iv) The central control of the DBMS provides better management of the integrity of the database by means of security and consistency checking to prevent misuse of the information stored.

There are 4 main approaches to providing data management services for a GIS:

i) The File Processing Approach

This involves development of a proprietary system to provide the individual data management services required by the different application models, for example the MAP Analysis Package developed by Tomlin (1983);

ii) The Hybrid Approach

This approach uses a commercially available DBMS (usually a relational one) for storage of the non-spatial attributes and employs separate software to manage the storage and analysis of spatial data (Morehouse, 1985), e.g. the ARC/INFO system from the Environment Research Institute (ESRI) and PANDA (an object-oriented database) from Kork Systems (Ingram and Phillips, 1987);

iii) The Integrated Approach

Using an existing DBMS as the core component of GIS to hold both spatial and non-spatial data (Healey, 1991). Extensions to the system are then developed where required, for example, GEOVIEW used the ORACLE database system to store spatial and non-spatial attribute data (Waugh and Healey 1986). The spatial data are stored in the entity table and the non-spatial attibutes are stored in the attribute table. The SQL query language is used for query and data manipulation (Waugh and Healey, 1987; Sinha and Waugh, 1988);

iv) Start from scratch and develop a spatial database capable of handling the spatial and non-spatial in an integrated fashion, for example, a Knowledge Based GIS (KBGIS II), (Smith et al., 1987) and MAPS (McKeown and Lai, 1987).

A DBMS provides a number of functions critical to the effective operation of a GIS. However, the difficulties of adapting existing DBMSes to handle spatial data have required that hybrid or modified DBMSes be developed. These development are leading to improved methods of representing and manipulating spatial and non-spatial data within a single environment (see Van Roessel and Fosnight, 1984; Van Roessel, 1985; Bundock, 1987)

4.4 Choice of System for the Jinjang/Kepong Squatter Settlement GIS

For the implementation of the case study squatter GIS, the ARC/INFO (ESRI Inc. Redland C.A.) software was chosen because of its wide availability on minicomputers and PCs. The ARC/INFO system consists of two components: ARC, the spatial data handling system and INFO, a standard relational DBMS. This GIS is one of the most widely used system available today (Dangermond and Burn, 1986; Wiggins et al., 1987; Green, 1987; Rais and Suharto, 1990; Yeh, 1990).

ARC/INFO is a GIS system built around a hybrid data model. It uses a vector topological approach to the handling of digital map data and a relational approach to the storage of attributes for map elements.

The topological structure of ARC/INFO has three very important advantages,

i) Polygon boundary data are efficiently stored as structured networks of line segments or areas, rather than as closed polygon loops;
ii) Certain types of spatial analysis which are not practical without topological structure can be performed;
iii) The structure allows for storage and processing of very large map coverages using a tiling structure and "Map Librarian" type facilities.

The relational type file handling DBMS used by ARC/INFO allows the user to associate and interrelate information from several files by matching selected codes which are common to each file.

ARC/INFO contains attribute manipulation capabilities which can be combined in a number of ways to support further analysis. They include:

a) Record Selection - The RESELECT command in INFO can be used to select a subset of records for further manipulation. INFO supports a full set of arithmetic and logical operators which can be used in specifying selection criteria;

b) Relate/Join - Records from two or more INFO files can be related by using a common item between the files;

c) Calculate/Update - New values for items in an INFO data file can be calculated using standard set of arithmetic functions including addition, subtraction, multiplication, division, exponentiation, data calculation, natural log and width determination for character items;

If complex tabulation of the attribute data is required either INFO programming can be used, or the data can be transfered into the ORACLE database (ORACLE Corporation, Belmont, CA), which has sophisticated query-processing facilities, using the ARC/INFO - ORACLE interface.

INFO data manipulation facilities, which include its capability to cross-tabulate, are widely used to produce various tables in Chapter 5 onwards. These summarise the socio-economic characteristics of households in the squatter settlement.

4.5 Data Management and Manipulation using ARC/INFO

In a GIS, geographic information is not approached as a drafting task but as a database application. The advantages of organising data using a DBMS include minimising redundancy in data storage, providing central control of data access, manipulation, integrity and security of the database and making application programmes independent of the form in which data is stored (see Rhind, 1981; Rhind and Green, 1988; Masser, 1988).

To keep abreast of the development of squatter settlements, information on squatter settlement has to be updated frequently. Using aerial photographs in addition to field survey, information on squatters can be up-dated and the information obtained can be automated and added to the appropriate ARC/INFO coverages. ARC/INFO provides a flexible system to update coverages, for example, using the UPDATE (merging new features via "cut and paste") and ERASECOV (erasing part of a coverage before adding update features) commands.

As indicated earlier, data organisation is an important component of town planning work. In this case, squatter and land related information is organised within the GIS so as to optimise the convenience and efficiency with which it can be used. The form of organisation chosen will be influenced by the types of data to be used, the types of analysis to be performed and the methods used to encode data.

In the case of a paper map, the map itself is both the means of storing the geographic information, as well as the form of presentation. Both these functions require some compromise to be made between the amount and accuracy of information that can be shown and the need for a map to be legible. In a computer based GIS, these organisational considerations are handled somewhat differently. The level of detail at which geographic information can be stored is only limited by the storage capacity of the hardware and the method used by the software to represent the data. Large coverage areas are subdivided into smaller units for more efficient storage, in a manner similar to the map sheet concept. Each unit is commonly stored as a separate set of data files. For the study area, the coverages were divided into 9 sets of data files since a single map would have to cover a very large area. Unlike the paper maps, ARC/INFO can provide sophisticated functions to ensure that adjacent units match precisely along their border. The subdivisions are conveniently hidden from the user, thus presenting a seamless coverage of the entire area as if it were a single very large map.

The different types of thematic information of the study area are treated as different data layers in a GIS. When a coverage is needed for analysis the map database is merged using the MAPJOIN (combining one coverage into another coverage) or APPEND (merging the same feature classes from adjacent coverages) commands.

4.6 Analysis of Spatial Data

Other advantages of GIS over other information systems derive from its spatial manipulation and analysis functions. This is largely due to the fact that the GIS database is a model of the real world which in turn can be used to mimic certain aspects of reality (Aronoff, 1989). The value in using a model is that it can be tested and manipulated more conveniently at a faster rate and in a less expensive way. In many cases, the model can be used repeatedly to test alternative scenarios (see Chapter 8). Another application is predicting the consequences of proposed activities (see Chapter 7). This ability to model responses to certain recommendations provides the opportunity to select the "best" alternative solution. The part it cannot answer is the human value judgement that defines the wants, goals and the value of the organisation and society that are using the information.

In carrying out the geographical analysis of the study area, the following steps were taken:

1) Establishment of objectives and criteria for squatter improvement;
2) Preparation of data for spatial and tabular analysis;
3) Performance of spatial and tabular analysis;
4) Production of final maps and tabular reports.

The ability of GIS to analyse spatial and non-spatial data at the same time is fully appreciated in the analysis. The following 4 categories of functions will be used:

i) Retrieval, classification and measurement;
ii) Overlay operations;
iii) Neighbourhood functions;
iv) Connectivity and Network functions.

(i) Retrieval, Classification and Measurement

Retrieval operations on the spatial and attribute data involve the selective search, manipulation and output of data without the need to modify the geographic location of features or to create new spatial entities. Selective retrieval can be performed by issuing a RESELECT command, for example to produce a map showing only the land parcels owned by the government with a value of less than $3.00 per square foot.

The command reads (see Appendix F for item definitions and values),

RESELECT OWN = 2 AND VAL LE 2

This kind of retrieval is efficient and can be used to analyse the data for the squatter area rapidly.

In the above example, the selected land parcels can be generalised to reduce the level of classification detail to make an underlying pattern more apparent. This can be performed by the DISSOLVE and ELIMINATE commands. These merge adjacent polygons which have the same value for a specific item and selected polygons with neighbouring polygons by dropping the longest shared border between them, respectively.

(ii) Overlay Operations

Very often in planning and monitoring urban development, planners will want to extract information from two or more maps. For example, we want to know which land parcels belong to the government and are not needed for immediate use. Ownership of land may be encoded in one map while the development phase is in another map. GIS has the ability to intersect two polygons map coverages so that Boolean logic can be applied to the result. In ARC/INFO, a spatial join can be performed through either polygon overlay, point-in-polygon overlay, or line-in-polygon overlay depending on the needs and situations.

The followings are some of the facilities for overlay operations:

i) UNION - overlays polygons and keeps all areas in both coverages;

ii) IDENTITY - overlays points, lines or polygons on polygons and keeps all input coverage features;

iii) INTERSECT - overlays points, lines or polygons but keeps only those portions of the input coverage features falling within the overlay coverage polygons.

In the above example, as a result of overlaying the land parcel map and the zoning map, the third map is created displaying many small new polygons (Figure 4.2). It follows the procedure to retrieve data using the rules of Boolean logic to operate on the attributes and spatial properties. Boolean algebra uses the operators AND, OR, XOR, or NOT, to see whether a particular condition is true or false (Figure 4.3).

In ARC/INFO the RESELECT command is used to extract polygons which have the same value for a specified item or items. Thus, in the above example, the logical expression which reads:

RESELECT OWN = 2 AND PRLU = 3

will extract data on all government land which is not going to be developed in the near future. More complex examples using both overlay and Boolean logic functions will be given in the later part of the study.

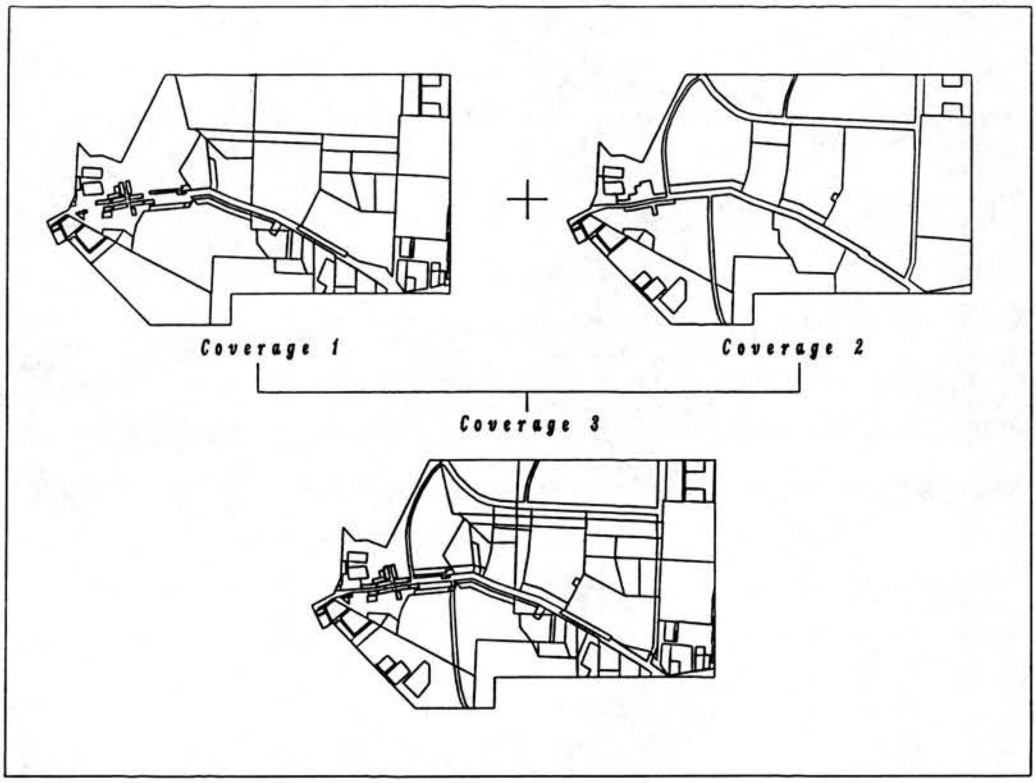


Figure 4.2: Process of Coverage Overlay

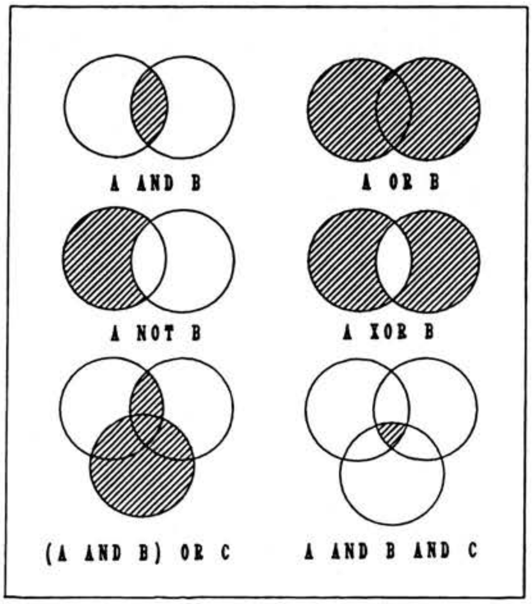


Figure 4.3: Venn diagram showing result of applying Boolean logic

(iii) Neighbourhood Operations

Virtually all GIS software packages provide some form of neighbourhood operations. They are particularly useful in evaluating the characteristics of an area surrounding a specific location.

In the squatter case study, neighbourhood operations are most useful in calculating the statistics for, and analysing the characteristics of squatters households on each individual land parcel. This is done by windowing into the selected land parcel and linking to its attributes in the squatter database.

(iv) Connectivity Functions

Connectivity functions are useful in the squatter study, particularly in measuring the extent of existing problems, in terms of provision of standard utilities such as power and piped water. Every connectivity function must include the following: (1) a specification of the way spatial elements are interconnected; (2) a set of rules that specify the allowed movement along these interconnections; and (3) a unit of measurement. Among the common connectivity functions are proximity and network analysis. Proximity analysis is often called buffer zone generation. The BUFFER command in ARC/INFO which creates buffer polygons around selected coverage features is used, for example, to measure the accessibility of public facilities, namely road, electricity and water supply, public phones, rubbish disposal etc. to the public. Since connectivity functions provide considerable flexibility in defining units of measure, the travel time in this case is of greater interest than simple metre distance. The numbers as well as the locations of these facilities can be matched to the squatters within a certain buffer zone to find the users of the facilities. If the squatter area is to be upgraded, the lack of facilities can then be corrected in a targetted fashion.

Another connectivity function is network analysis. A network is a set of interconnected linear features that form a pattern or framework. In ARC/INFO, NETWORK analysis is used for route optimisation and resource allocation. With the existing problems of sanitation and provision of standard utilities in squatter settlement, the most cost-effective way of installing utility lines, with entry and exit points from specific sites, and the requirement to serve potentially all of the dwelling units on a given site, needs to be examined. ARC/INFO NETWORK can be employed, although this requires digitizing of possible routes through the site, perhaps following existing paths. These can be evaluated to find the best network design. This problem can be investigated under several different assumptions, namely, all existing dwelling units remaining unchanged, some units being demolished, for example those in a very dilapidated condition, or the site being laid out afresh.

4.7 Data Output and Automated Mapping

Output is the procedure by which information from the GIS is presented in a form suitable to the user. Maps and tables are common output from GIS systems. Data are output in one of three formats; hardcopy, softcopy or electronic. The hardcopy ouput is normally from a pen or electrostatic plotter. Softcopy output is the format as viewed on a computer monitor and is normally used to allow operator interaction and to preview data before the final output. Output in electronic formats consists of computer compatible files. They are used to transform data to other computer systems either for additional analysis or to produce a hardcopy output at a remote terminal.

Thus, automated mapping allows efficient handling and dissemination of thematic information, so that interpretative maps can be produced quickly for planning and decision-making. The planner and other interested parties will be able to assess accurately and quickly the answer to numerous "what-if" enquiries, with the aid of computer-generated maps and graphics. Cross-tabulations between the items related to the dwelling units can be generated and ARCPLOT RESELECT (which selects a set of coverage features based on their attribute value) can be used to plot selected items. The map coverage can also be overlaid with another coverage, for example, parcel ownership and building coverage. Flexible automated mapping is an important part of data manipulation. It allows examination of different scenarios and characteristics of the area depending on selected items (Yaakup et al., 1990). Maps showing different time frames with alternative development proposals for squatter areas can also be drawn.

4.8 User Interfaces

One of the issues in GIS application is the user-accessibility. It can be much improved through the use of a macro language, for instance, the Arc Macro Language in ARC/INFO.

4.8.1 Detailed Interface Considerations

There are a number of approaches currently available to design interfaces (see Sutcliff, 1988), including:

a) The Command Driven System or Base Level System

   This approach assumes that the user knows the actions desired and the commands to carry them out, thus a certain familiarity with the system functionality is required.

b) The Query Language Based System

These languages (for example, the Structured Query Language (SQL)) are increasingly simple to use but complex in operation, but again it is assumed that the user has some knowledge of what results are required and how to achieve them.

c) The WIMP-style interface (Windows, Icons, Menus and Pointers)

This kind of interface design approach has seen much development in recent years and has a high level of user acceptance. It is therefore finding rapidly increasing acceptance in the PC software environment, particularly for novice users. All the options are displayed on screen in a carefully controlled environment. A menu structure is easy for the occasional user to work with, but it may be too slow for the experts. Providing a faster means of interaction, such as a command line option, may better satisfy the requirements of this group of users.

In designing a user interface for the squatter planning GIS, menus, command line options and SQL were employed, embedded in the Arc Macro Language (AML) system (ESRI, 1989).

4.8.2 The Arc Macro Language (AML)

The Arc Macro Language (AML) provides full programming capabilities within the ARC/INFO environment. It has a set of tools to tailor user interface design to any application with, such features as creation of on-screen menus with text files, a function to report on the status of the parameters of many ARC commands, and the ability to get and use map or page unit coordinates (AML Manual, ESRI, 1987).

In addition to it, AML includes an extensive set of directives and functions that can be used interactively or in programmes. AML directives are the element of the language which determine the flow of control and perform in-line functions (i.e mathematical, string manipulation, user input and file system functions) which instruct the processor to perform some actions.

The directives can be grouped into:

a) General Directives - which include a debugging device (the &WATCH facility), user output (&TYPE) and a help facility (&HELP);

b) FLow-of-control Directives - which provide the programme logic control for AML (e.g. nested &IF and &SELECT statements, &IF...&THEN...&ELSE directives, &GOTO directives, &CALL directives and &DO groups);

c) Variable Manipulation Directives - which provide facilities to define, assign and modify variables (e.g. &SETVAR and &DELVAR);

d) Input Source Directives - which permit the user to open, read and close specific files (e.g. &RUN, &MENU and &TTY);

e) Graphic Input Directives - which provide facilities to enable the user to get and use coordinates from the graphics environment (e.g. &GETPOINT and &PUSHPOINT).

In addition to the directives, AML has a a list of functions which include general functions, file system functions and user input functions.

4.9 Conclusions

The ability of GIS to link digital cartographic data and the associated databases of attribute information has added a new dimension to the management, analysis and presentation of large volumes of information required in decision-making processes. It is apparent that such capabilities have a wide area of application. At the most basic level GIS provides tools for the storage, analysis and display of locationally referenced information. In the longer term, they offer the potential for large scale integration of a range of data for different urban and regional areas, which could provide more complete, detailed and rapid input to the planning and decision making process than is currently possible. GIS capabilities in urban planning will now be examined in more detail in the context of squatter planning for the Jinjang/Kepong settlement.

CHAPTER 5

IMPLEMENTATION OF THE JINJANG/KEPONG SQUATTER SETTLEMENT GIS

5.1 Introduction

Many planning decisions are taken to pursue well defined goals in the immediate present and the near term future. However, an important aspect of effective planning is avoiding unintended consequences of such decisions. Even the simplest decision making and anticipatory planning must take a long term view of all the decisions which are planned and must consider their impacts on all the goals of planning and all parts of the planned system within the forecast time frame. As regards the squatter problem in Kuala Lumpur, various strategies have been formulated at structure plan level. However, the result of these policies can only be seen at a more local level. On account of the dynamic nature of squatter movements, a GIS can assist both in long term planning as well as monitoring of squatter developments. The major part of this chapter is concerned with development of the GIS for the study area. In particular, attention is focused on: (1) the conceptual design of the Jinjang/Kepong GIS as a basis for subsequent implementation; (2) assessment of the environmental characteristics of study area using the GIS. Chapter 6 goes on to examine the study area in terms of its socio-economic characteristics and basic needs.

5.2 Conceptual Design of the Squatter Settlement GIS

Successful implementation of GIS for urban planning problems will largely depend on four factors. The first requirement is automation of the GIS database. It is costly to collect, store and sift through large quantities of unnecessary data. Hence, the most cost effective approach is to collect only the data required for the specific task, in this case, for planning and monitoring of squatter area developments. Secondly, data collected either from existing records, aerial photography or field survey will need to be integrated using GIS methods. The squatter GIS will be organised so as to facilitate adhoc query and analysis. Thirdly, the ability to perform spatial modelling, so alternative scenarios can be generated. Lastly, application of valid criteria to evaluate the effectiveness of possible planning strategies before the final solution is determined.

Figure 5.1 illustrates the conceptual design of the squatter related information system. It consists of the following 10 main data layers: (1) the base map; (2) squatter buildings; (3) parcel records; (4) planning zones; (5) road networks; (6) water supply networks; (7) electricity networks; (8) land use; (9) physical environment; and (10) the study area boundary. These layers are required for monitoring the growth of squatter settlements in the city. In particular, the authority needs to know the socio-economic characteristics of the

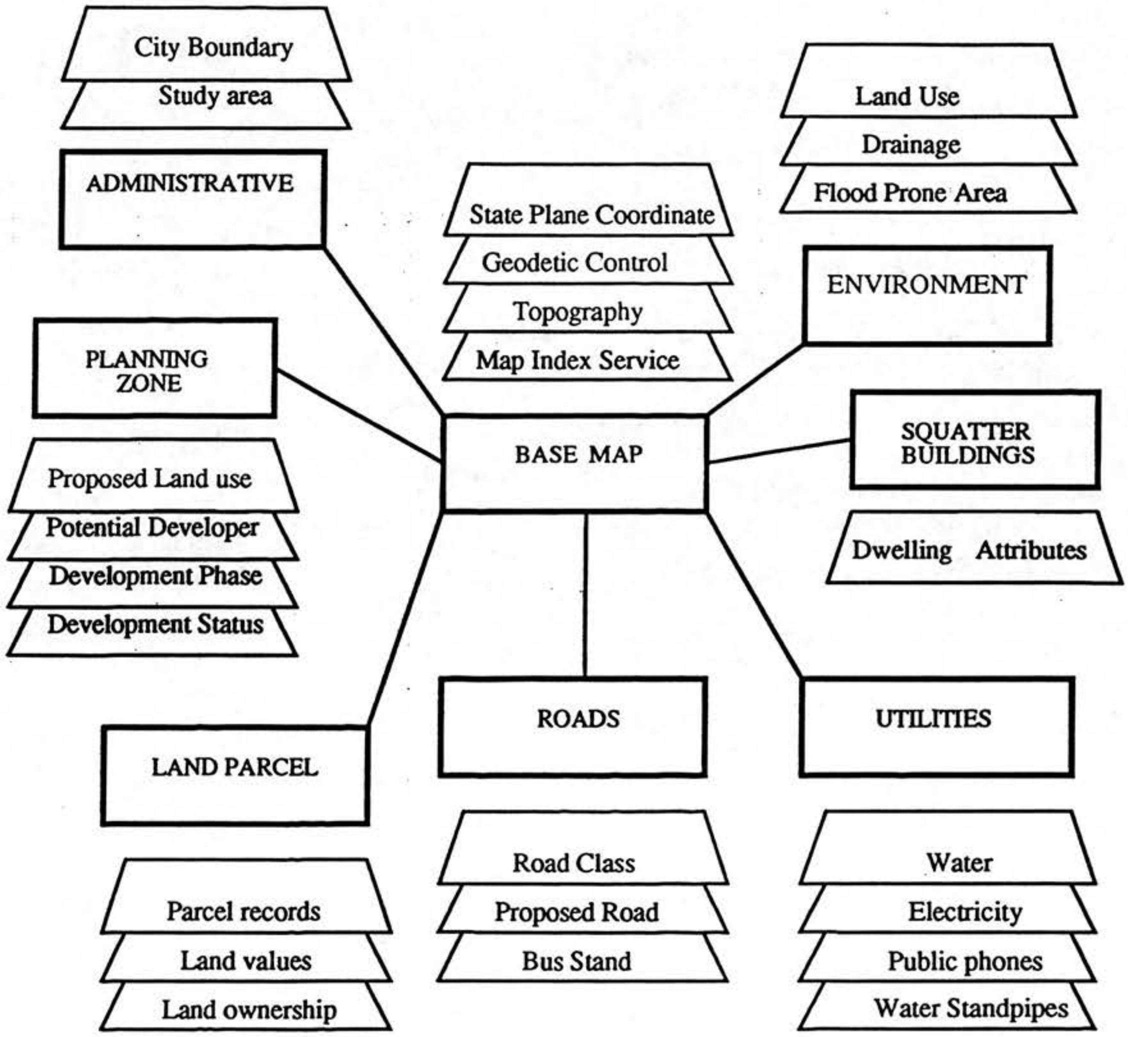


Figure 5.1 : Conceptual Design of Jinjang/Kepong Squatter GIS

Potential Use	Base Map	Environmental Map	Land Parcel	Road Network	Electricity	Water Supply	Squatter Buildings	Land Use	Planning Zone	Boundary Map
1. Economics Situation			●				●			
2. Demographic							●			
3. Social Characteristics			●				●			
4. Basic Needs				●	●	●	●			
5. Housing Needs			●				●			
6. Modelling of Squatter Policies and Programmes	●	●	●				●	●	●	●
7. Evaluation of Alternative Planning Scenarios	●	●	●				●		●	
8. Provision of Infrastructures			●	●	●	●	●			
9. Review of Local Plan	●	●	●				●		●	
10. Zoning Control	●		●				●			
11. Squatter Upgrading				●	●	●	●			
12. Land Suitability Study for Housing Programme	●	●	●					●	●	●

Table 5.1 : Data Requirements for the Squatter GIS

squatters and be able to ask questions such as who they are, where they squat and on whose land. Understanding of squatter behaviour and the attitude of squatters towards housing is important in formulating the development policy of the area. Table 5.1 illustrates, more specifically, the potential use of the database and the data layers for specific components of the study. It can be seen that certain aspects of the study i.e. demographic analysis can be done using information selected from a single data layer, i.e. squatter buildings. A more complicated analysis will involve several data layers. For example, in evaluation of alternative planning scenarios, several data layers need to be combined namely, drainage, land parcels, squatter buildings, land use and planning zones.

In addition, the local authority needs to recognise the consequences of local planning for the squatter areas. GIS will provide the scenarios for the proposed developments or other alternative solutions. This will give them the opportunity to review the local plan and adjust their planning and management accordingly, at no cost to the squatters themselves. It will also allow the development to be coordinated since the agencies associated with the project planning and implementation can have access to the database.

5.3 The Study Area

For the purpose of implementing the designed database, the Jinjang/Kepong Planning Unit was chosen. An ex-mining area, Jinjang/Kepong is characterised by informal housing and ongoing squatting on vacant land. Most of the land is owned by the government. The study area lies to the northwest of Kuala Lumpur, about five miles from the city centre and is shown in Figure 5.2. The area has a total population of 35,000 and about 3000 households are squatters. The area contains a number of swampy "lakes" that occupy part of a former open-cast tin mine.

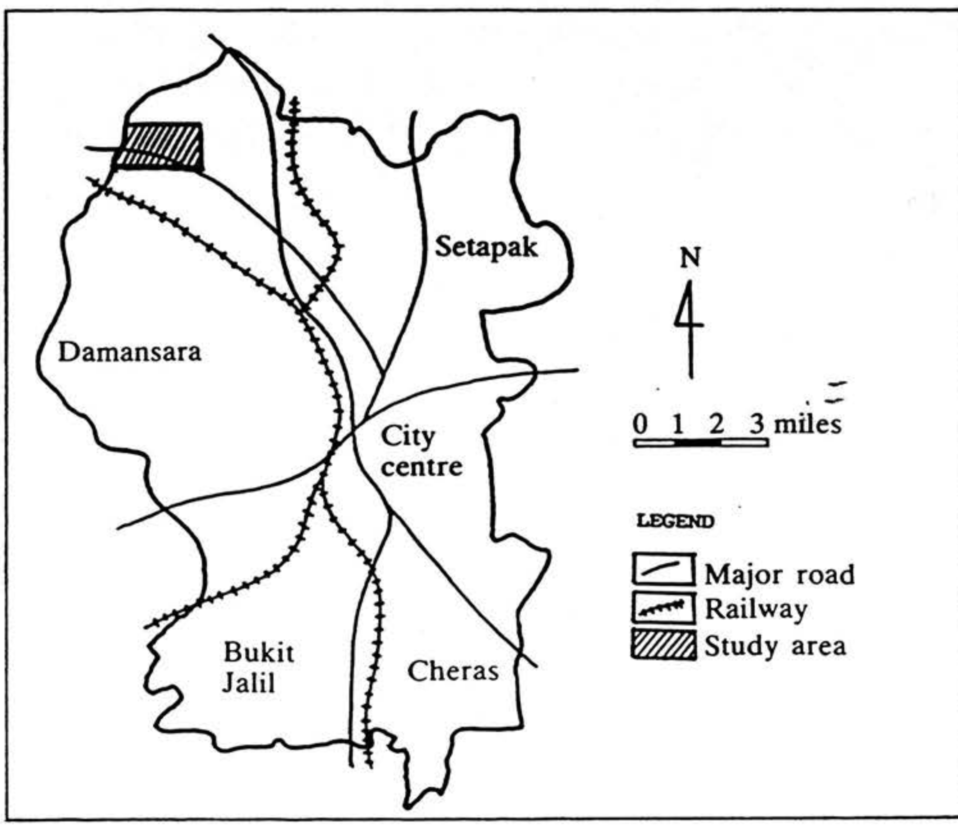


Figure 5.2: The study area within Kuala Lumpur

Source of background map: Department of Urban Planning and Building Control, DBKL, 1989.

The first squatters in the Jinjang/Kepong squatter settlement were the Chinese Immigrants who came to work at the tin-mining companies. The earlier workers lived in temporary shelters made with wooden walls and palm leaves/bamboo roofs. When a mine was abandoned and the workshop was moved to another place, they dismantled their shelters and went to other areas. Later, they settled and formed villages and squatter settlements. Most of the land they currently occupy is abandoned ex-mining land. The process of settlement first began when the mining activity was no longer active. At this stage, the land was very unstable because of mining activity and was therefore left vacant. When the land consolidated, yet no planned development occurred, the squatters started to move in and reclaim the land to build houses. The squatters who reclaimed the land to meet their own needs do so at their own risk. No permanent legal status or land title is given to them. They are also subject to eviction at short notice. Since there was a lack of control by the authority, during the period 1960-80 the squatters began to increase in number. When one section of the area became heavily populated, a new section would be reclaimed. After 1980, the local authority enhanced their control and this reduced the expansion of settlement into new areas.

The Jinjang/Kepong settlement was chosen mainly because it lies in the mainstream of urban development. It is surrounded by various land uses, mainly planned housing estates and industrial concerns. Owing to its location, the area receives constant pressure to be redeveloped in a more economic manner. The Kuala Lumpur Structure Plan has also identified the Jinjang/Kepong settlement as an area with high potential for redevelopment. Major investment is expected to be made in the future planning programme of this area. Before such a programme can take place, the area needs to be analysed in terms of its development capacity as well as the needs of the squatters who are currently occupying the area. Furthermore the area has quite a mixture of uses and thus enables a better assessment of the usefulness of GIS in the planning and monitoring of squatter settlements.

5.4 Implementation of the Jinjang/Kepong Squatter GIS

The objectives of implementing the squatter GIS are:

i) to develop and update the information on squatters and related information using existing maps, aerial photographs and field survey;

ii) to develop a detailed inventory and analysis of physical and socio-economic factors relevant to the development of squatter settlements;

iii) to analyse the development potential of squatter areas and to evaluate alternative scenarios.

The systematic collection of data on the Jinjang/Kepong squatter settlement is envisaged to be of great value for future work on upgrading, improvement or redevelopment of the study area.

In implementing a GIS, the creation of the database is of utmost importance. Several problems arose in creating the Jinjang/Kepong squatter GIS which will be discussed below.

5.4.1 Problems of Implementing the Squatter GIS

The main problem of implementing squatter GIS was the lack of existing data. This is true for any project associated with squatter settlements (Kajagi, 1982; Aziz, 1982; de Bruijn, 1984; Leekbhai, 1987; Sliuzas, 1988). Most information on squatter areas in Kuala Lumpur was last gathered ten years ago, i.e. during the preparation of the Kuala Lumpur Structure Plan. It largely covered socio-economic aspects of the squatters and was collected on a sample basis. Information on physical characteristics, including housing condition, infrastructure and land related information was not collected. Since squatter settlements are always on the move, most of the available data were also found to be out of date.

Some existing information, although available in certain public departments, for example the Town Planning Department, was difficult to retrieve. This was mainly due to poor maintenance and record keeping by the department. Some information had been lost in the process. The tedious work of sifting through collection of documents had to be carried out to determine what information actually remained.

As indicated earlier, squatters planning requires not only socio-economic data, but also physical as well as land related information. No one department holds all this information. For example, the Land Office have information on land parcels, but information on utilities have to be collected from the Public Works Department. Certain data, for example, topographical maps and aerial photographs, were treated as confidential. Much effort was required to extract what limited information actually proved to be available, so a substantial amount of fieldwork had to be undertaken, which will be discussed later in the chapter, to meet the necessary information requirements.

5.4.2 Development of the Squatter GIS

The following stages were identified as being the necessary steps in developing the squatter GIS: (1) updating of information; (2) digitizing of map sources; (3) development of digital elevation data; (4) development of the attribute database for dwelling units. These will now be examined in turn.

(i) Updating of Information

Traditionally, urban planning in Malaysia is carried out using existing base maps as a starting point for data collection. Large scale maps (on a scale of 1 inch to 2 chains or 1:1584) of the Jinjang/Kepong area have been prepared on the basis of 1974 vertical aerial photographs (scale of 1:5000) produced by the Directorate for Survey and Mapping, Malaysia. These maps contain information such as the location of buildings, terrain elevation, the road network, vegetation and natural drainage. These maps however are not ideal for use as planning base maps for the following reasons:

i) the relatively long production time means that the maps are outdated when released;
ii) the maps are not specifically made for planning purposes and certain information for example, land information, public facilities and utilities are not included;
iii) property boundaries and subdivisions of land are not up-to-date.

For detailed planning, such as that associated with squatter settlements, a large amount of physical and socio-economic data has to be collected from existing departmental records, ground checking of aerial photography and through household interviews.

Before gathering detailed information on the area the base maps have to be brought up-to-date. Photogrammetric techniques together with field survey, permit the rapid collection and updating of squatter information. The maps were updated based on aerial photographs from 1981 (scale 1:10,000) (Figure 5.3), photo mosaics from 1987 (scale 1:10,000) (Figure 5.4) and field checking. Aerial photographs provide a synoptic view of the squatter area and can be used to obtain a variety of data related to activities occurring within it. The data include geometric data such as the approximate location and size of objects, as well as attribute data describing some of the characteristics of objects or land features (i.e. land use, building functions, road network characteristics, drainage, etc.).

The Jinjang/Kepong base maps were updated by the author using simple photogrammetric instruments i.e., a zoom transfer scope, a sketch master and zoom/mirror stereoscopes. Extracting these data from aerial photographs requires appropriate skills, while intepretation of aerial photographs, being based upon observation and deduction on the part of the photo intepreter is therefore not without error. The objects identified were transferred to the existing maps, while extra information which was difficult to obtain from aerial photographs (such as property boundaries and utility lines) was gathered from related departmental records or field checking. However, record keeping in

Figure 5.3: Area Photograph (1981) showing part of the Study Area, scale 1:10,000

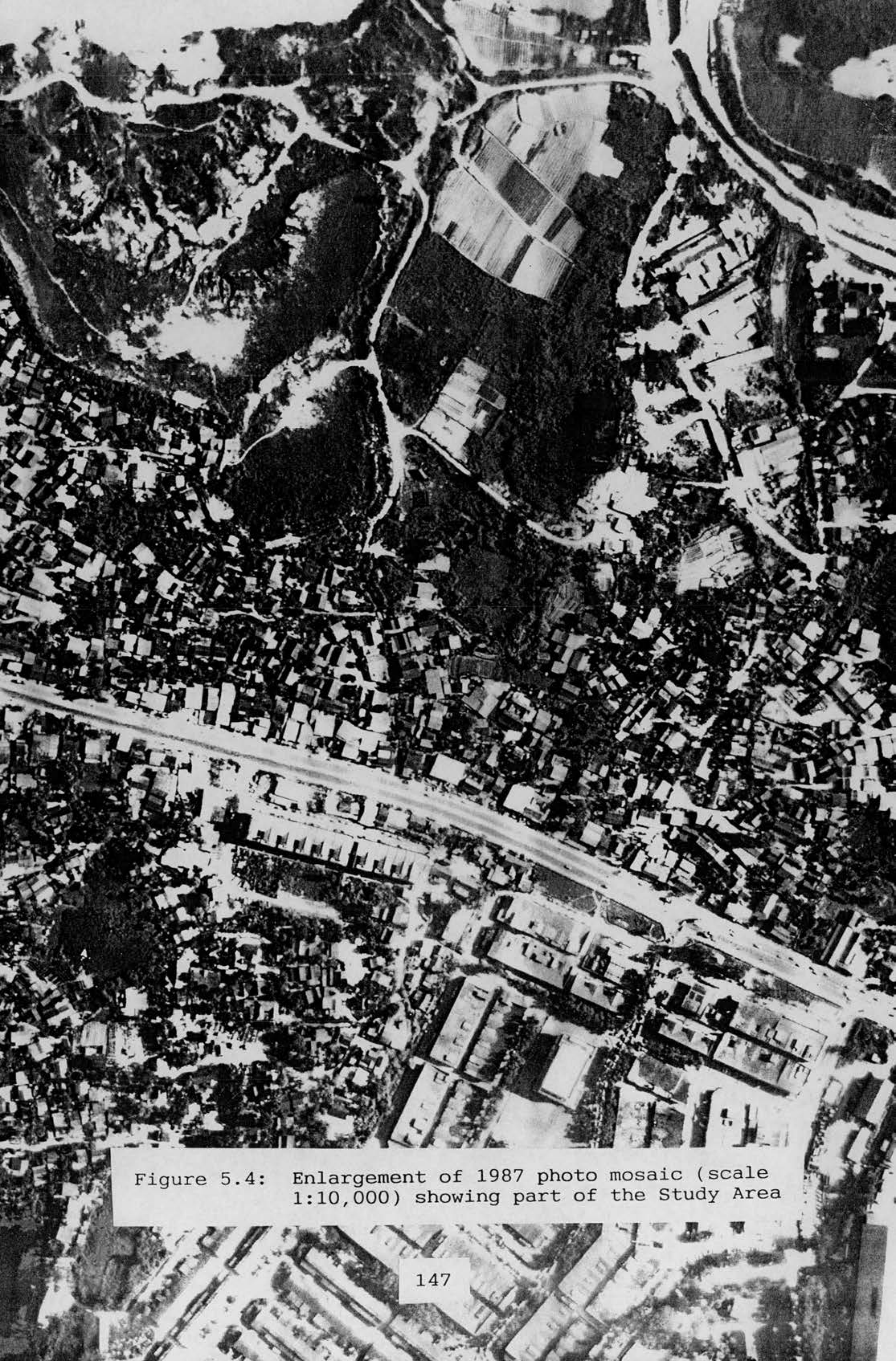


Figure 5.4: Enlargement of 1987 photo mosaic (scale 1:10,000) showing part of the Study Area

public agencies does not facilitate efficient retrieval and certain information was witheld because of confidentiality. As a result most of the information was gathered in the process of ground truthing.

A detailed field check on individual squatter buildings was carried out and information recorded on the updated base maps. Problems of data accuracy were also experienced in the field survey and should not be seen as a characteristic peculiar to photo intepreted data. Nevertheless extensive photo interpretation and ground survey have been used in the study to increase accuracy and obtain an acceptable standard of data for the planning of the squatter settlement.

The field work for the study area was carried out in February - May 1989. It had two main objectives:

i) to prepare and update squatter and other land related data i.e. public facilities, land use, parcel information and the physical condition of buildings based on existing records, aerial photographs and ground checking;

ii) to conduct 100% door-to-door household interviews (2134 households) in the study area. The purpose of the survey was to obtain the following information:

   a) Physical characteristics i.e. building use, building material, building condition, number of rooms;

b) Demographic characteristics i.e. multiple family occupancy, number of persons per household;

c) Socio-economic characteristics i.e. occupation, income, saving;

d) Transportation i.e. vehicle ownership, distance to work-place, mode of transport;

e) Squatting characteristics i.e. reasons for squatting, duration of squatting;

f) The housing preferences of the squatters, i.e. type of house, price, number of rooms, location and method of housing development.

A questionnaire was designed to include all the above information. A copy of the blank questionnaire is contained in Appendix C. The interviews were carried out by the author with the help of two enumerators. The total number of respondents was 2134, so the 100% coverage was successfully achieved. The information collected has allowed an attribute database to be designed which provides extensive information for the dwelling-unit coverage (see Appendix D for item definitions (UP2BL.PAT file) of a dwelling-unit coverage).

(ii) Digitizing Map Sources

Data were entered by manual digitizing from the updated map sheets (on a scale of 1 inch to 2 chains (1:1584)) which were based on the state plane coordinate system.

Since the map sheets were in the North Western quadrant, the coordinates have to be transformed using the PROJECT command in ARC/INFO. As the map elements were traced, the data coordinates generated from the map by GIS were stored for later processing. The data processing involved conversion and rectification of data from map sheets recorded in imperial units to map sheets with data in metric units. Digitizing was carried out on 9 separate map sheets. Once digitized, each coverage was then manipulated to fit other coverages using the edge matching facility (i.e. MAPJOIN, EDGEMATCH) in ARC/INFO. It should be stressed that the efficiency of digitizing depends on the quality of the digitizing software and the skill of the operator. The ARC/INFO digitizing and editing facilities (ARCEDIT) help minimise the effort of detecting and correcting errors.

In ARC/INFO a coverage is a digital analog of a single map sheet and forms the basic unit of data storage. Several classes of features may be present in a coverage. Each feature class has locational and thematic information associated with it. Locational information may be represented explicitly (e.g. as a series of coordinates on an x,y plane). Locational information may also be represented topologically (e.g., by its relationship to coverage features or as combination of other features). Coverage features are represented by both coordinates and topology. Coverage topology is created using the CLEAN and BUILD commands.

For the study area, several separate coverages were digitized, edited and cleaned. The coverages included the base map, squatter buildings, road networks, electricity networks; water supply networks; areas of environmental hazard, land use, land parcel, planning zone and study area boundary.

(iii) Digital Elevation Data

Digital elevation data are a set of elevation measurements for locations distributed over the land surface. They are used to analyse the surface features of an area. The methods used in the study to capture and store elevation data are contours and a Triangulated Irregular Network (TIN). Using the TIN data structure, the topography of the study area can be shown using the VIEW command.

(iv) Development of the Attribute Database for Dwelling Units

For detailed planning, such as that associated with a squatter settlement, substantial amounts of data need to be collected. It is essential that these data be stored in a way which will allow easy retrieval and manipulation.

A fundamental characteristic of the ARC/INFO system is that all cartographic or spatial elements (points, lines and polygons) are linked to an associated database of attributes. These attributes are carried through all the stages of analysis. The proprietary database management system INFO, which forms part of ARC/INFO, allows the user to manipulate and update the attribute data. Once the digital map coverage has been established, attribute coding of the map elements can take place. Having the raw data successfully loaded into ARC/INFO data layers, and coded, it was possible to begin data manipulation.

5.5 General Assessment of the Jinjang/Kepong Squatter Settlement

The first important role for the Jinjang/Kepong squatter GIS was assessment of the current situation in the squatter settlement. The first task was to obtain a profile of the area and assess the following:

1 The impact of environmental problems on the squatter community;

2 The characteristics of the existing squatter settlement and its associated community;

3 The effectiveness of existing services in the squatter settlement.

5.5.1 Environmental Problems

(i) Topography and Soil

The development of the Jinjang/Kepong squatter settlement up to the present time is, to a large extent, a reflection of the area's topography and soil.

The geographical core of the area is a gentle plain standing at a height of 140 ft. above mean sea level. It is this plain that contains the major part of the settlement. Encircling over half of the area to the north is a wide belt of tin mining land which stretches beyond the boundary of the area. Figure 5.5 shows a three dimensional view of the area generated from contours and spot heights using the VIEW facility in ARC/INFO TIN. It was then DRAPE'd with the existing squatter buildings to show their distribution in relation to the topography.

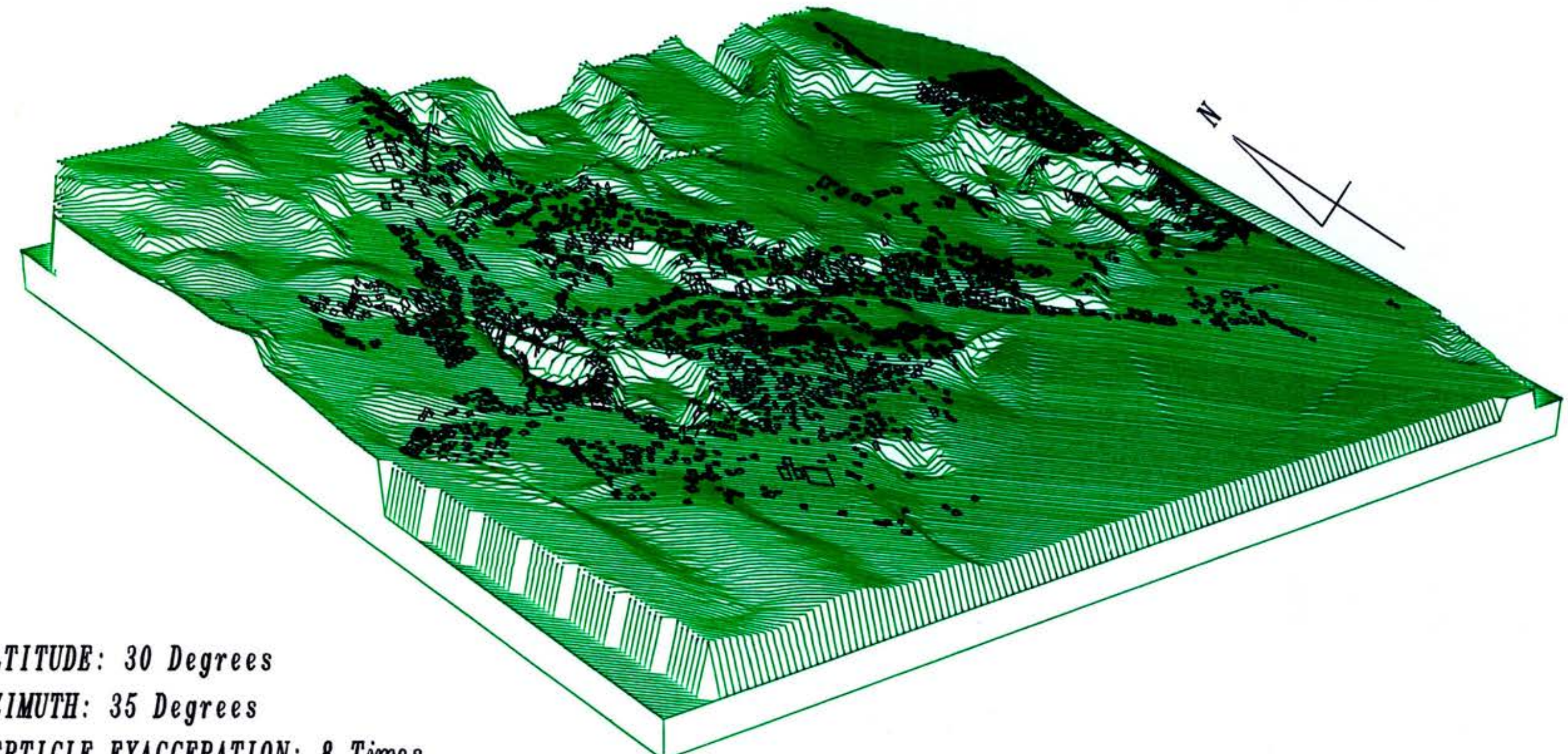
The physical features of the area are typical of ex-mining land (open cast mining). The obvious physical features are piles of rocks, gravel and pebbles, which in most cases form small hills or mounds. Years of abandonment and exposure changed the physical features to some extent. Sand tailings were inevitably eroded by the rain, leaving after some years white mounds with thin vegetation.

The common result of all types of mining is soil disturbance. This affects soil structure, texture and composition, chemical properties, water retaining capabilities and soil temperature. A common soil profile of the area is a clayey layer, a sandy layer, an interbedded clayey layer and a hard layer. Figure 5.6 shows the common features of the soil profile of ex-mining land as described by JICA (1981).

JINJANG/KEPONG SQUATTER SETTLEMENT

PERSPECTIVE VIEW

Figure 5.5



ALTITUDE: 30 Degrees

AZIMUTH: 35 Degrees

VERTICLE EXAGGERATION: 8 Times

Compiled by Ahris Yaakup on ARC/INFO, July 1990

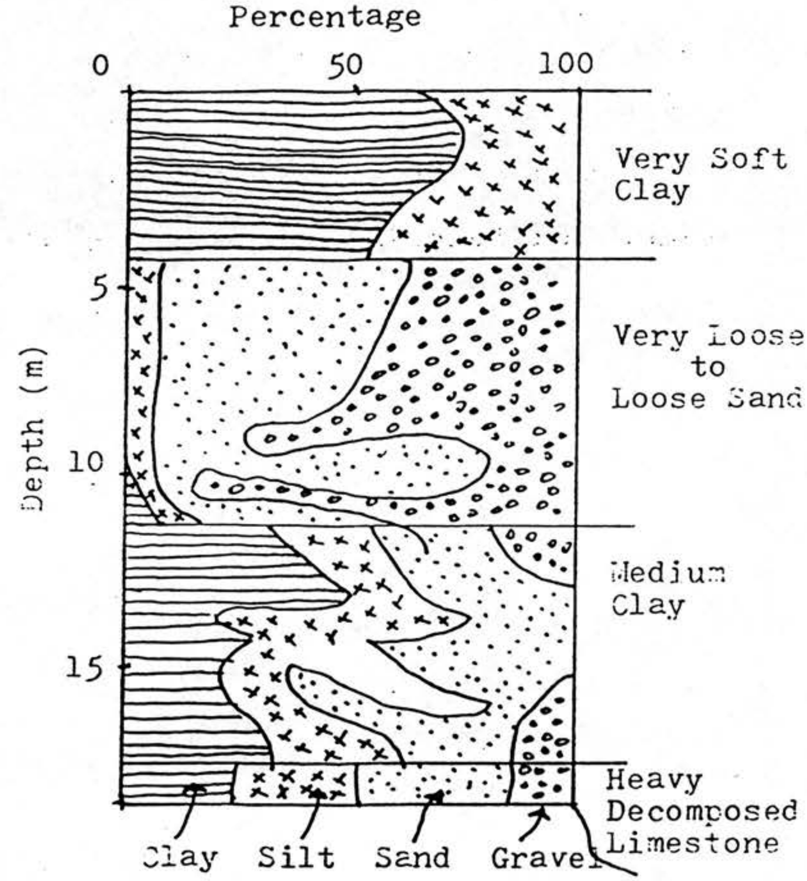


Figure 5.6: Typical Soil Profile of Kuala Lumpur Mined Land

Source: JICA, (1981) The Reclamation of Ex-mining Land for Housing Development, A report to Malaysian Government, Kuala Lumpur

The nature of the soil of former tin mining lands makes reclaiming the land for either plant growth or building extremely site specific. Proper site surveys to investigate the relevant factors before reclamation are essential. Investigation to identify appropriate techniques of reclamation is time consuming, costly and requires expert knowledge (Ibrahim, 1986). On account of that, most ex-mining lands were abandoned. They however provide land for the squatters to build houses and engage in gardening or fish rearing.

(ii) Drainage and Flood Prone Area

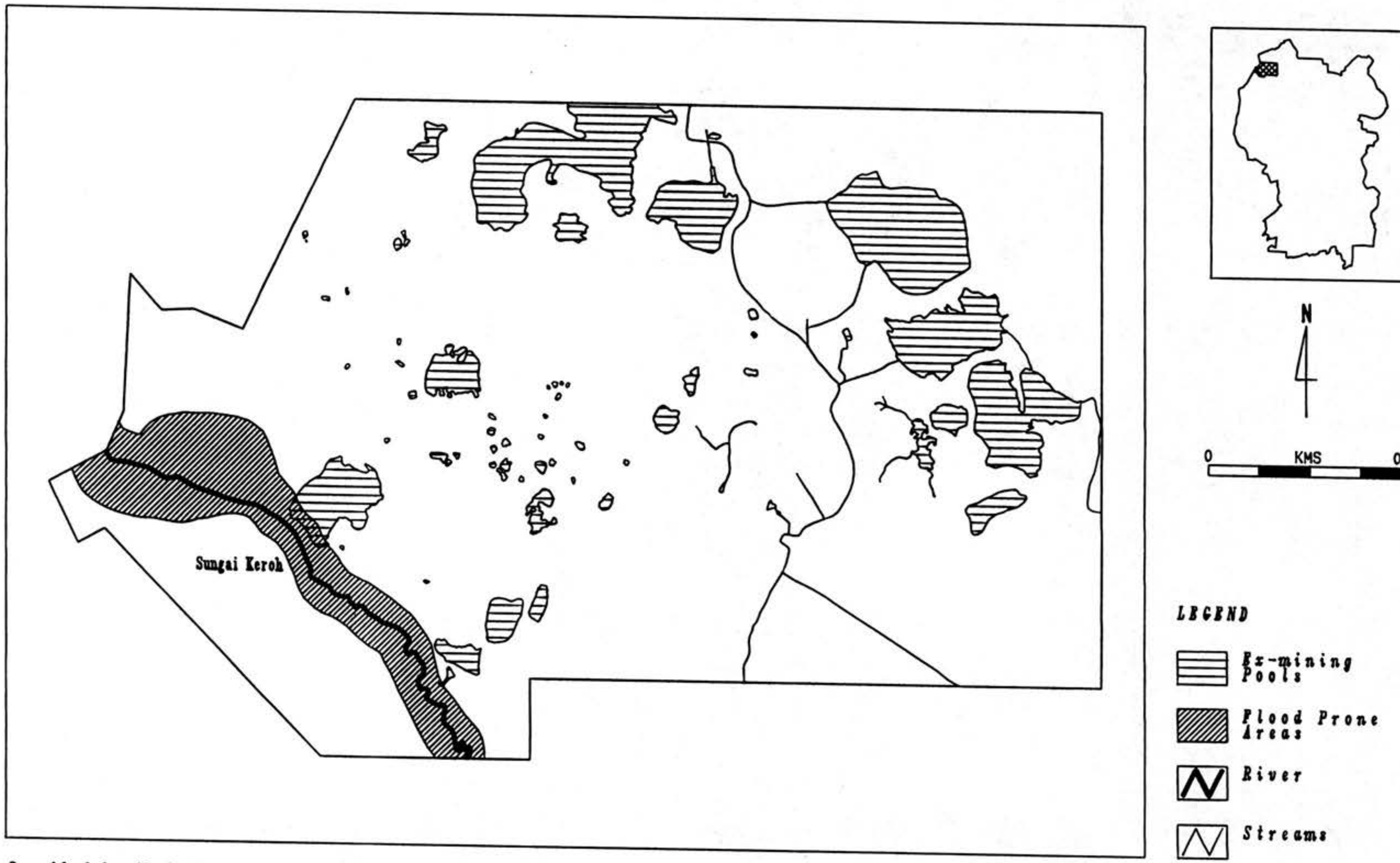
The Jinjang/Kepong squatter settlement has developed without adequate investigation, much less proper planning, of the area. The squatters built houses on former mining land which had not been properly reclaimed. Inadequate water drainage and soil instability are the problems most squatters area have to face. This very often leads to storm water flooding. Most of the squatters who settle on the abandoned mining land to meet their own needs are subject to the flood hazard. The occurrence of flooding is closely related to the climate. In Malaysia, the climate is tropical with annual precipitation averages nearly 100 inches with the greatest amount in February and July.

Drainage of the study area is by means of a number of natural and man-made drains, although most are natural. The backbone of the system is Sungai Keroh and its tributary. The next major element in the drainage system is the network of trunk drains. Feeding the trunk drains are the drains from the squatter area (generally road side drains) (Figure 5.7).

JINJANG/KEPONG SQUATTER SETTLEMENT

EXISTING DRAINAGE SYSTEMS AND FLOOD PRONE AREAS

Figure 5.7



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The overall drainage system of the area is considered poor. It depends mostly on the small streams which drain into the ex-mining ponds. These ponds retain runoff during heavy rainfall. The areas around the ponds are prone to flooding under these conditions.

The study area also experiences storm water flooding. This is mainly caused by rainfall of long duration over a widespread area. The flooding usually occurs because of (i) upstream developments which have increased storm water runoff; (ii) restricted flow because of downstream construction; (iii) inadequate drainage provision; and (iv) developments being permitted in the flood prone area.

At present there is one area subject to flood due to the deficiencies in the trunk drainage system. After heavy downpours, various sections of the Jinjang town, main road and squatter areas are flooded to a depth of 1-3 feet. This often disrupts traffic flow and causes nuisance to some residents and squatter dwellings (Figure 5.7). The flooding is often caused by increased developments in the city and the construction of line channels with little regard to whether the downstream channel can accept the flow. During heavy storms Sungai Keroh often overflows its banks because the channel is too small to cater for increased runoff.

5.6.4 Characteristics of the Squatter Settlement

(i) Land Use

At present, there are three significant types of development which have taken place on abandoned ex-mining land in the Jinjang/Kepong squatter settlement. These are (a) housing; (b) industry and commercial; and (c) agriculture (Figure 5.8).

Table 5.2: Existing Land Uses in the Jinjang/Kepong Squatter Settlement

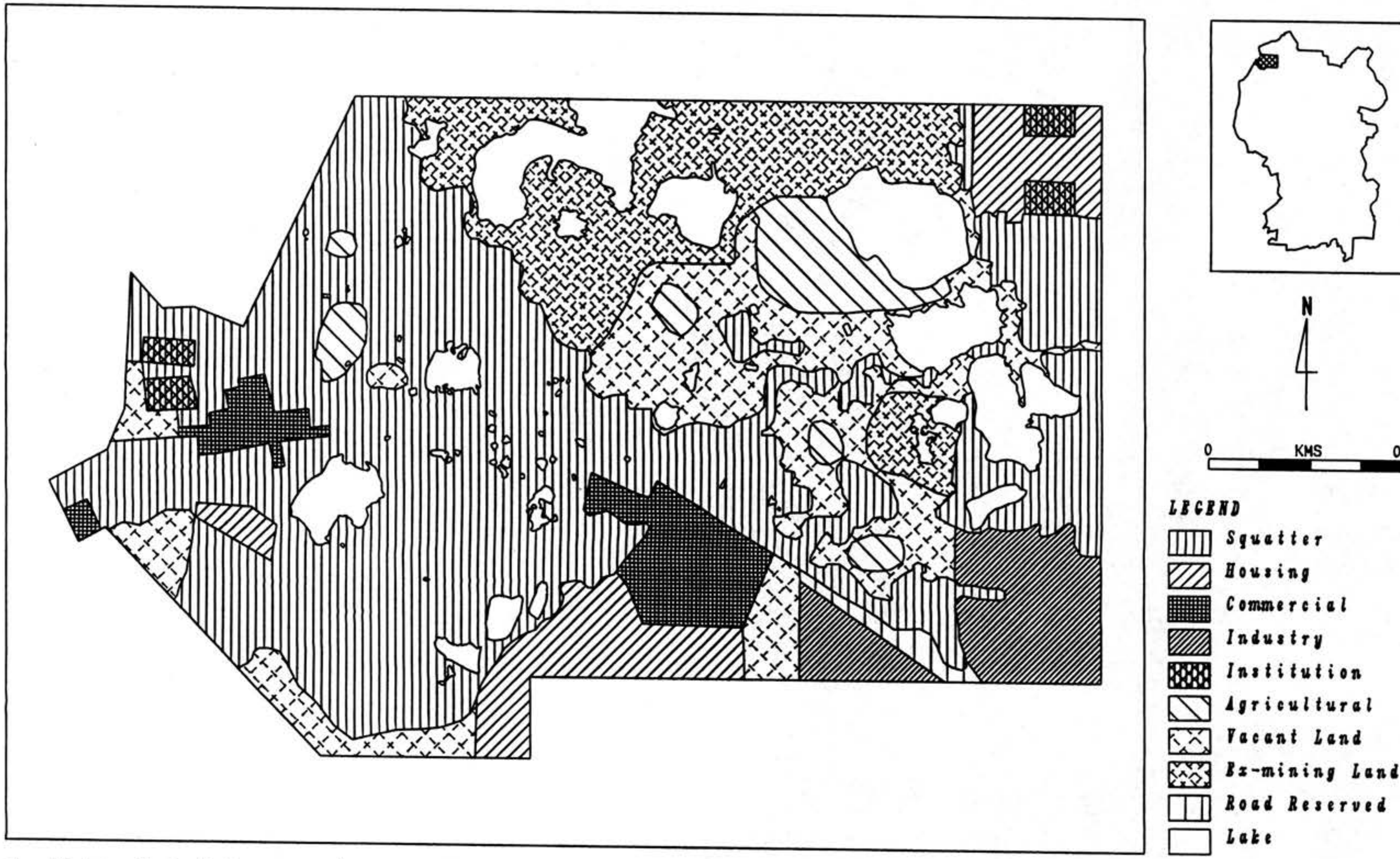
Land Use	Area (Hectare)	%
Squatter dwellings	142.3	43.5
Housing estate	20.4	6.2
Commercial	13.8	4.2
Industry	16.7	5.1
Institutions	3.6	1.1
Agriculture	12.7	3.8
Vacant land	43.5	13.3
Ex-mining land	37.9	11.6
Lake	34.3	10.5
Road reserve	2.0	0.7
Total	327.2	100.0

Source : Jinjang/Kepong Squatter GIS, 1990

In the Jinjang/Kepong area, squatter dwellings, commercial and industrial establishments occupy about 142 hectares of former mining land, while 12.7 hectares have been reclaimed for agricultural use (Table 5.2).

JINJANG/KEPONG SQUATTER SETTLEMENT
EXISTING LAND USE

Figure 5.8



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(a) Residential Development

Residential development, especially squatter settlement on ex-mining lands has been rising continually in recent years. This results from the increasing demand for housing, especially for the lower income groups.

Although residential development has been in progress for a number of years it still has not received full support from the government. Squatter housing is called "illegal" and "unhealthy" while public and private low-cost housing is considered too expensive. Low-cost housing has also been built on ex-mining land, but the public as a whole is sceptical about such developments because there have been incidents involving land subsidence and the cracking of building structures, due to inadequate piling on earlier housing projects (JICA, 1981).

The quality of land played an important role in the development of the Jinjang/Kepong squatter settlement. In this context land quality refers to its suitability for the construction of squatter dwellings, commercial or industrial establishments. The important characteristics to look for are whether the land is stable, dry, marshy, subject to periodic flooding or steeply sloping.

In general there are two landscape forms in the Jinjang/Kepong squatter settlement. The first of these is the area which is occupied by the squatters to be used for dwellings, industrial or commercial establishments. These are the older parts of the ex-mining land which are relatively large, flat and stable. The squatter dwellings are usually clustered close to the main road and along the tracks left by mining activities. Other areas which are not yet stable for buildings to be built on are mainly used for agricultural activities. They are usually located near the ponds or other water sources which can be used to irrigate the farms.

Secondly, there are the areas which are not suitable for any activities, because of the surface mining which has taken place there, leaving soil structure and texture greatly disturbed in many places. The land is devoid of vegetation and has also completely lost its fertility (Zen, 1982). In addition, there are also ponds left on cessation of mining activity. People usually breed fish in the smaller ponds. The bigger ponds are usually left undisturbed. In the shallow pools, hydrophytes grow, while in the deeper ponds floating plant species range from very fine plankton to large water lilies, which are found in abundance.

In addition to the squatter settlements there are other non-squatter developments around the area. These include schools, shops, housing estates and factories. These facilities are a great asset to the squatters while the factories become the main source of employment. There are also new developments being planned along the southern fringe of the squatter area. The trend of these developments seems to indicate that the squatter area is being slowly encroached upon and pressured by controlled development.

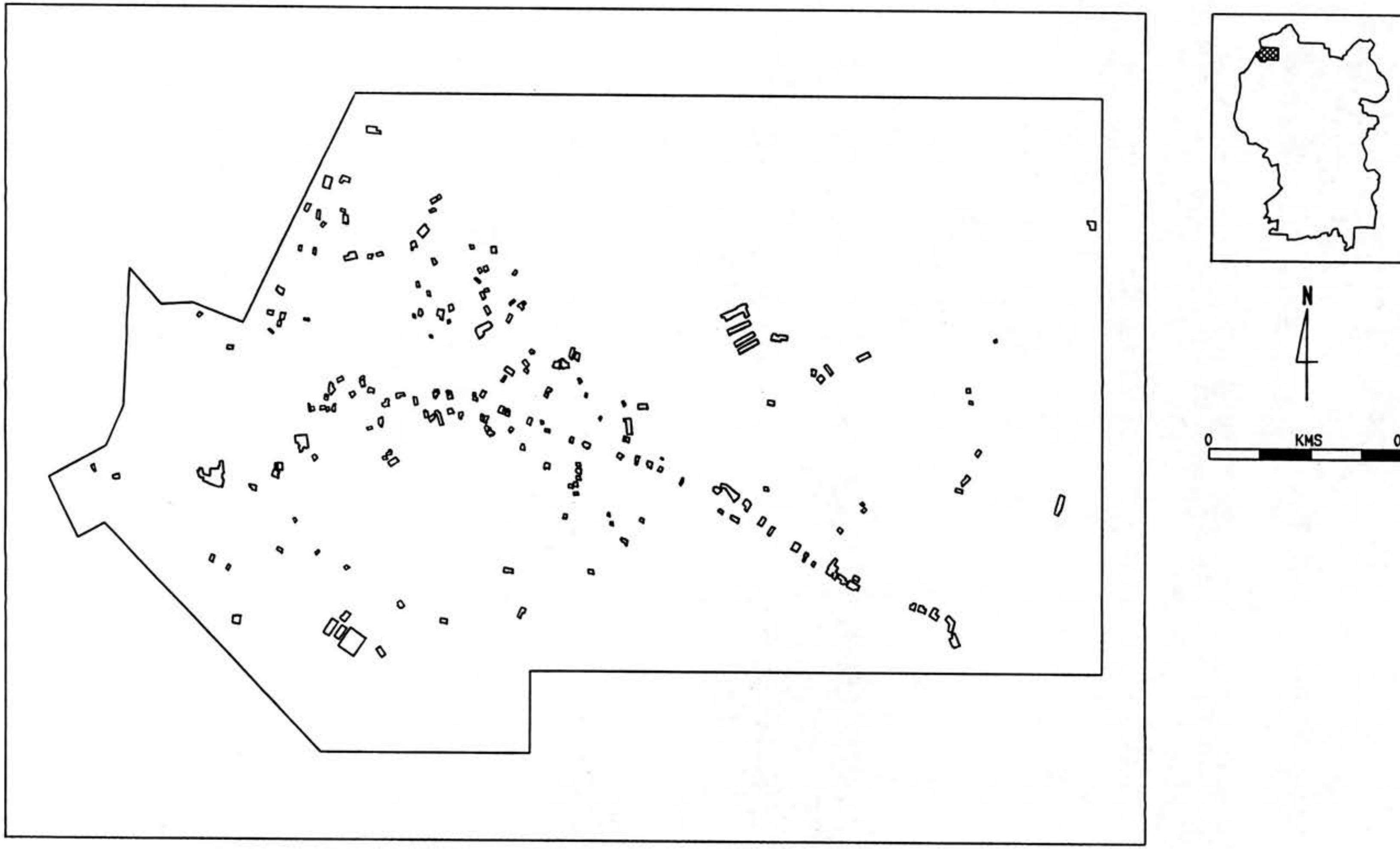
(b) Squatter Industries

Some tracts of the unreclaimed tin mining lands are relatively flat, open, large and stable. They are suitable for certain types of industrial activity i.e. light and small scale or domestic uses. In Jinjang/Kepong area there are 196 industrial concerns and 70 commercial establishments. The floor area for industry is relatively large with a median floor space of 2400 sq. ft. The floor area ranges from 300 sq. ft. to 27,000 sq. ft. Even though the number of firms and commercial establishments is small compared to the number of houses i.e. 11% of the total building units, they occupy about 18.5% of the total floor area. These establishments are scattered all over the area (Figure 5.9). A large proportion of the industries are made up of free standing buildings (80%) built among the houses, while the remaining 20% have a mixed use for both commercial and dwelling purposes (Table 5.7). The construction of the buildings was not properly regulated, and this has resulted in overcrowding especially along the main road. Consequently they cause traffic congestion, environmental hazards and often face the risk of fire.

JINJANG/KEPONG SQUATTER SETTLEMENT

EXISTING SQUATTER INDUSTRIES

Figure 5.9



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A detailed study (carried out by the World Bank Consultant Dieter Unverzagt together with Caj Fakke, a United Nations advisor to the Urban Development Authority in 1974) has shown that the squatter industries at that time were profitable businesses with an average turnover of $26,500 for a site of half an acre.

Typically the industries are labour intensive with a small capital base and limited investment in equipment. They provide employment opportunities for nearby squatters. The products include wooden boxes, various metal products, waste paper, cement products and potteries. There are also a number of dealers in scrap metal and timber, including repair shops.

The industrial concerns are able to purchase the land at market prices and many would be able to buy a site outright if it was made available. The industrial concerns appear to be squatting essentially for three reasons (Wehbring, 1976):

1 The difficulty of purchasing small plots of industrial land;
2 In the absence of any pressure on them from the authority, it was convenient and advantageous to continue squatting;
3 To minimise the initial cost of setting up a business.

These industries require low cost space during the initial years. By squatting these enterpreneurs have been able to minimise initial cost and become established. Once established they are well able to afford the land at the market rate.

Industrial development on the open mine lands should be regulated by the local authority. Industrial activities are not always compatible with other land uses, particularly residential which occurs on most of the unreclaimed lands. On account of this, the potential for industrial development seems limited. It requires special zoning to avoid conflicts in use.

According to the Jinjang non-statutory local plan (DBKL, 1988), all the squatter industries will be relocated in either Jinjang/Kepong areas that are zoned for industrial use or in some other areas in Kuala Lumpur, for example, at Wangsa Maju or Bandar Tun Razak. The plan also states that squatter industries located in areas which are to be zoned for industrial use, will not be relocated, provided that the industries are consistent with the proposed layout of the area.

(c) Agricultural Squatting

In addition to squatter firms, there is also agricultural squatting; these operations include vegetable farming, raising poultry and pigs, fish farming in former mining ponds and growing orchids for export. The farms are small, often a family enterprise with an average of 2.5 workers per farm. Agricultural methods are intensive with fertiliser and irrigation being employed and several crops harvests per year.

Farming is a suitable interim use for government owned land. By occupying the land, farms prevent encroachment into an area by residential squattering which is of a more permanent nature. Short term leases can be provided which limit the residential use of areas allotted for farms to the tenant farmer and his family, and where necessary to a few agricultural workers.

Table 5.3: Value of Land by Uses of Land

Land Values $/acre	less than 1		1 - 3		3 - 5		5 - 10		Total	
Land Use (Hectare)	Area	%	Area	%	Area	%	Area	%	Area	%
Squatters*	4.4	2.6	32.6	19.7	68.2	41.2	60.5	36.5	165.6	100
Agriculture	3.9	27.1	6.7	46.5	3.8	26.4	0.0	0.0	14.4	100
Total	8.3	4.6	39.3	21.8	72.0	40.0	60.5	33.6	180.0	100

Source : Jinjang/Kepong Squatter GIS, 1990

* This includes squatter dwellings, squatter industries and public buildings.

Unlike the industrial concerns, these market gardens cannot bear the full market cost of urban land. Nearly half of the agricultural land falls within the $1.00 - $3.00 per acre land value range (Table 5.3).

In summary, the squatters have settled on the ex-mining land which they found to be stable. Such settlement, however is illegal and is not in conformity with the planning regulations. Such areas have a potential to be developed in a more economic manner. In addition, there are ex-mining areas and pools which are not yet stable and need to be adequately reclaimed before any development can be put forward.

(ii) Land Ownership

The 1989 squatter population of Jinjang/Kepong squatter settlement is estimated at 13,288 people comprising 2401 households living in 2134 dwelling units. They occupied 142.3 hectare of land resulting in a density of 16.9 buildings per hectare (Table 5.4).

Table 5.4: Area and Buildings by Status of Land

Status of land	Area (Hectare)	%	Building Units	%
Private land	21.4	15.0	130	5.7
Government land	120.9	85.0	2281	94.3
Total	142.3	100.0	2411	100

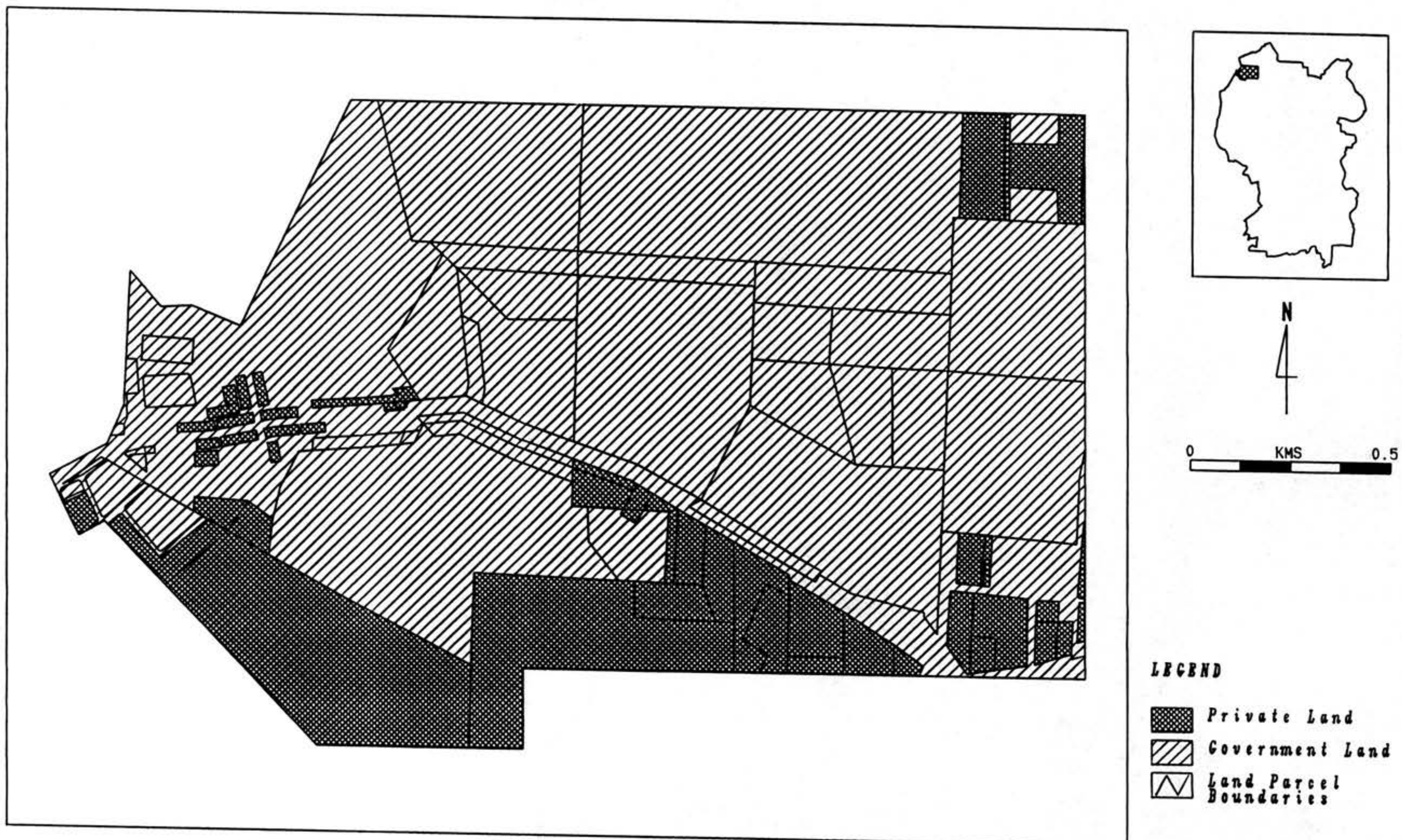
Source: Jinjang/Kepong Squatter GIS, 1990

Of this land 85% is government owned and this is mainly made up of a former tin mine. Only 15% of the squatter land is privately owned (Figure 5.10). Of the government land, 10% is reserved for government institutions and

JINJANG/KEPONG SQUATTER SETTLEMENT

LAND OWNERSHIP

Figure 5.10



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another 15% is reserved for a government privatisation programme (the concept of government privatisation programme is explained in Chapter 7) (Figure 5.11 and Table 5.5).

Table 5.5 : Types of Government Owned Land

Types of government land	Area (Hectare)	%
State land	91.2	75.0
Government Institution	11.0	10.0
Government Privatisation	18.7	15.0
Total	120.9	100.0

Source : Jinjang/Kepong Squatter GIS, 1990

The average building density on government land is significantly higher than the density on private land i.e. 19 and 6 dwellings per hectare respectively (Table 5.6). This implies there is a tendency for squatting to take place on unused government land rather than private land. The squatters feel more secure on the former land, and at the same time, hope that the government will in due course award the land to them.

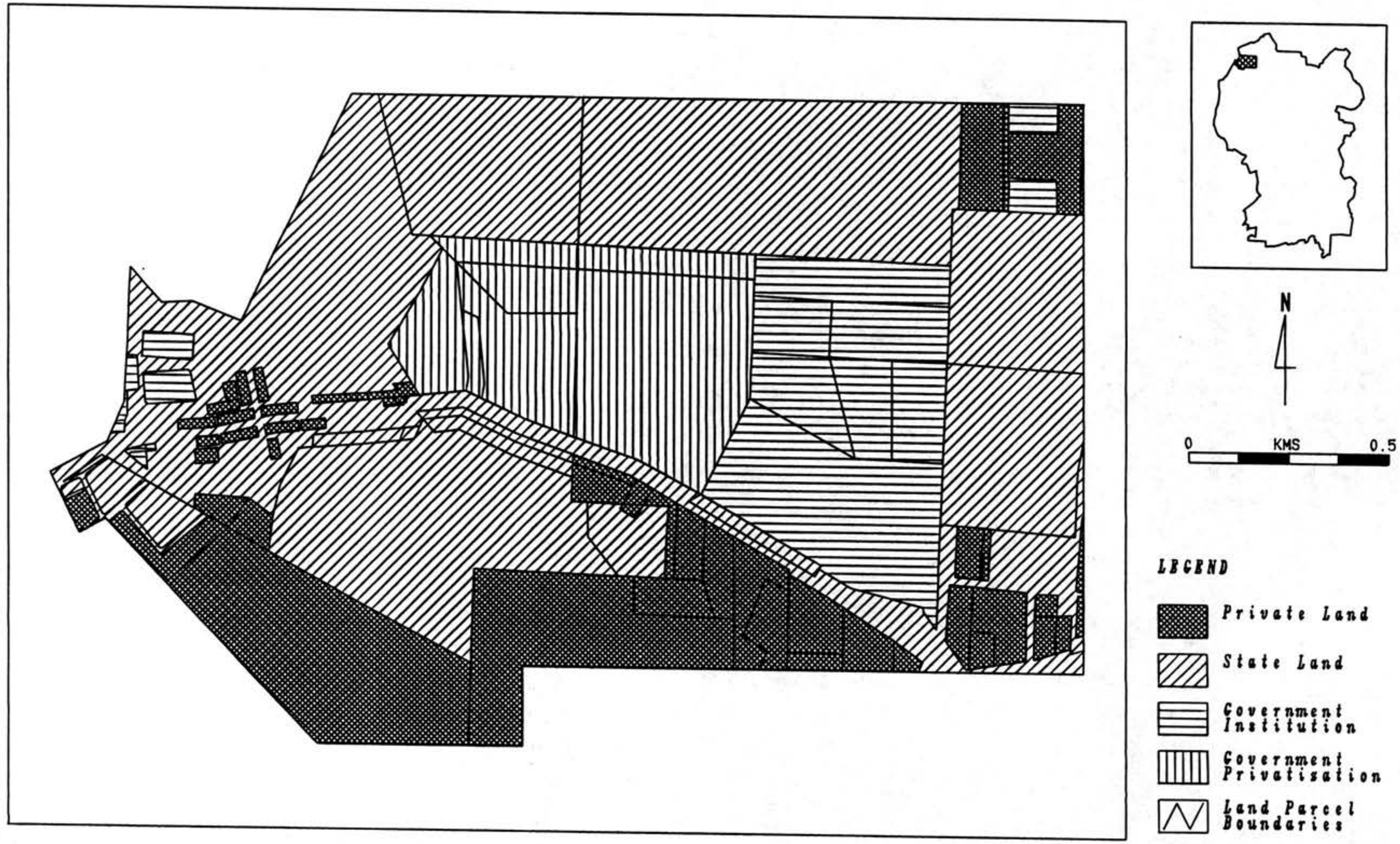
Table 5.6: Density of Squatter Dwellings by Types of Land

Type of land	Area (Hectare)	Dwellings per hectare	Population per hectare
Private land	21.4	6	37
Government land	120.9	19	118
Total	142.3	17	93

Source : Jinjang/Kepong Squatter GIS, 1990

Figure 5.11

JINJANG/KEPONG SQUATTER SETTLEMENT
DETAILED LAND OWNERSHIP



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An essential element in the definition of 'squatter', whether they are on private or government land, is their lack of title or written permission to occupy the land. However, there are certain marginal cases whereby there appear to be 'semi-squatters', at least from the legal point of view. They are those who have been allowed, or even encouraged to occupy unofficially, often paying a certain amount as land-rent on a monthly or yearly basis.

Even for those occupying the government land, some of them consider themselves to have some kind of permission to stay there. They claim to possess Temporary Occupation Licences, leases or even grants. If it is true, these people are not, strictly speaking, squatters. They have been given the right to occupy the land even though it may be for a limited period of time. It is also possible that their licences or leases have already expired but they are claimed to be still valid by the squatters.

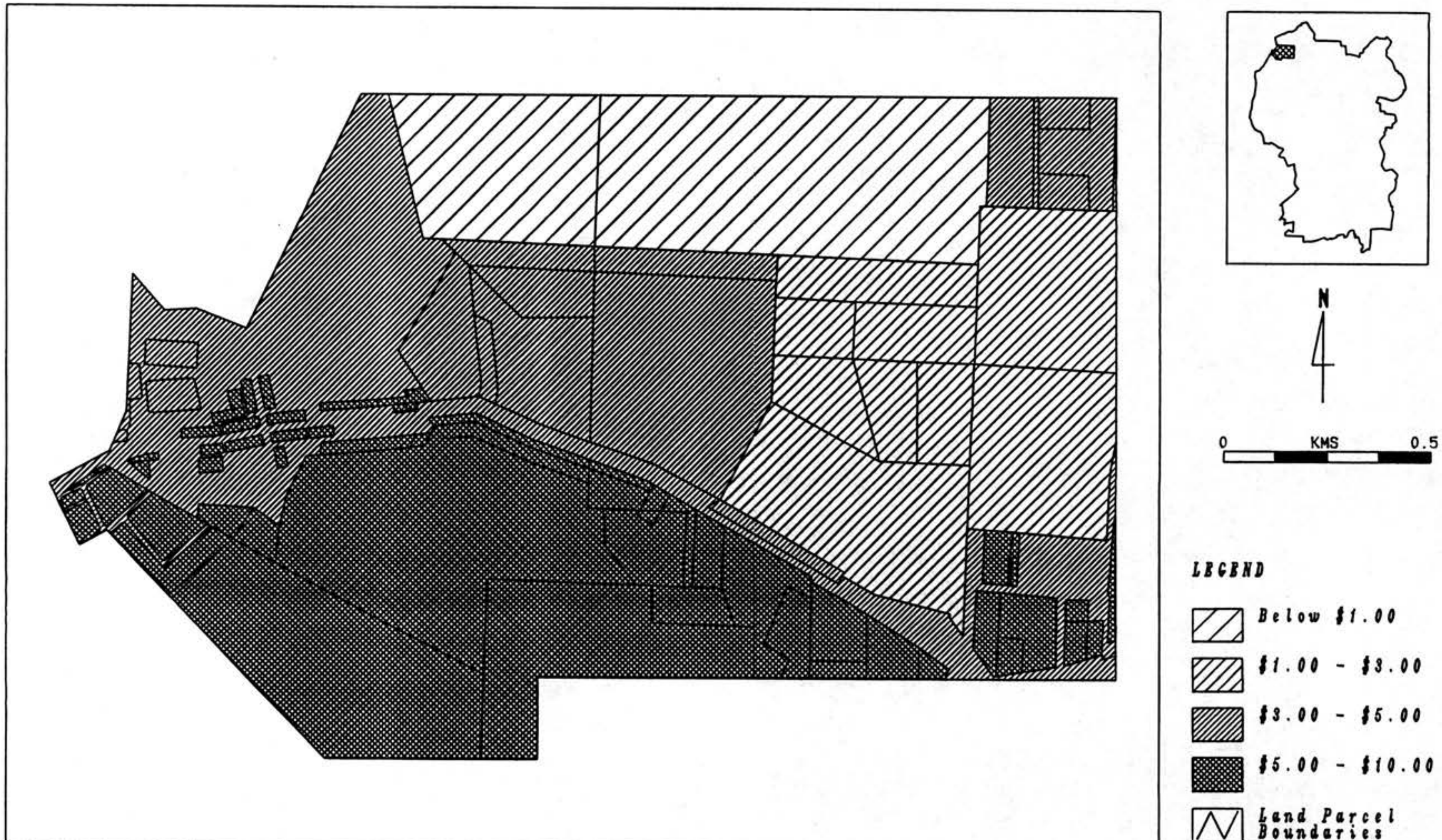
(iii) Land Values

Land values are influenced by many factors. These include location and accessibility; topography and other physical characteristics; legal tools like land use zoning, permitted use, permitted density and development; and the nature of development whether it is highly profitable or otherwise.

JINJANG/KEPONG SQUATTER SETTLEMENT

DISTRIBUTION OF LAND VALUES

Figure 5.12



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The break down of land values for the study area is shown in Figure 5.12. About 77% of the Jinjang/Kepong squatter area has a land value of more than $3.00 per square foot. Land with such a value is considered to be uneconomical for low-cost housing. Of that 35% is valued at a higher rate of $5.00 - $10.00 per square foot (Table 5.3). The people occupying such land face a higher threat of eviction since the land has potential for a higher level of economic development. Since the 1970's, urban developments in Kuala Lumpur have tended to expand towards the city fringes, consequently, the costs of such areas have also risen, especially along the main road. The study area, because of its location faces more pressure for urban development now than ten years ago.

5.5.3 Physical Characteristics of Squatter Buildings

(i) Building Type

Single building is the dominant building type in the area. More than 80% of the dwelling units and industrial buildings are single buildings. The majority of single dwelling units have three or fewer rooms (Table 5.7). The remaining 20% are semi detached and terraced buildings. This indicates the tendency for squatters to build individual dwelling units rather than to share their units.

Table 5.7: Number of Rooms by Type of Building

No.of rooms / Type	One No	One %	Two No	Two %	Three No	Three %	Four No	Four %	No Room No	No Room %	Total No	Total %
Single	494	89.7	974	85.1	490	88.8	100	92.6	11	84.6	1869	87.6
Semi-Detached	44	8.0	100	11.0	48	8.7	5	4.6	2	15.4	199	9.3
Terrace (1-3 units)	13	2.3	28	3.1	12	2.2	2	1.9	0	0.0	55	2.6
Terrace (>3 units)	0	0.0	8	0.9	2	0.3	1	0.9	0	0.0	11	0.5
Total	551	25.8	910	42.	552	25.9	108	5.1	13	0.6	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

(ii) Building Use

Buildings in the study area tend to congregate along existing roads and tracks, also around the pools. In the eastern area, however, buildings are more organised (Figure 5.13). Out of the total of 2411 buildings, 2134 or 89% are used as dwelling units (Table 5.8).

Table 5.8: Types of Buildings by Use

Building Type / Building Use	Single No	Single %	Semi-Detached No	Semi-Detached %	Terrace (1-3 units) No	Terrace (1-3 units) %	Terrace (>3 units) No	Terrace (>3 units) %	Total No	Total %
Housing	1869	90.1	199	78.3	55	84.6	11	64.7	2134	88.5
Industry	159	7.7	33	13.0	4	6.2	0	0.0	196	8.1
Commercial	36	1.7	22	8.7	6	9.2	6	35.3	70	2.9
Public use	1	0.5	0	0.0	0	0.0	0	0.0	11	0.5
Total	2075	86.1	254	10.5	65	2.7	17	0.7	2411	100

Source : Jinjang/Kepong Squatter GIS, 1990

These dwellings have different sizes and shapes and the floor areas range between 180 sq. ft. and 10,000 sq. ft.

Figure 5.13

JINJANG/KEPONG SQUATTER SETTLEMENT

DISTRIBUTION OF BUILDINGS

Compiled by Ahris Yaakup on ARC/INFO, July 1990

with an average of 1171 sq. ft. The total floor space of dwelling units makes up 82% of the total area of buildings.

Based on the Malaysian planning standards (Hai, 1976) 600 sq. ft. is the standard floor space for a 3 bedroom low-cost unit, it is found that 82% of the dwelling units can be considered as large with the remaining 17% small (Table 5.9). Of the large units, 46% have floor space of more

Table 5.9: Floor space of dwelling units

Unit size*	No	%
Small	376	17.6
Large	1758	82.4
Total	2134	100.0

Source: Jinjang/Kepong Squatter GIS, 1990

* This is compared to 600 sq.ft. as the standard floor space of a 3 bedroom low-cost unit. Anything less than 600 will be considered as small.

than 1000 sq. ft. With the density relatively low, families are able to build their house to fit their needs, limited only by the cost of building material. Consequently squatter houses are not small.

(iii) Building Condition

In formulating the future programme for a squatter settlement, consideration should also be given to the present condition of the squatter dwelling units. If certain squatter settlements need only to be improved, the condition of the dwellings will determine in large measure whether such dwellings will only have to be upgraded or completely rebuilt. In assessing the physical condition of the buildings it was found that 4% of the units were considered as "dilapidated" (built before 1965), while the majority of them i.e. 68% are described as "old" (built between 1965 and 1975). About 21% are considered as "moderate" (built between 1975 and 1980) and only 8% are recognised to be in good condition (built after 1980) (Table 5.10). Although this does not indicate that the general conditions of the squatters are good by the city's standard, it also does not give the image of "slums" as generally associated with the idea of "squatters".

Table 5.10: Condition of Buildings by Type

Condition	New		Moderate		Old		Dilapidated		Total	
Type	No	%	No	%	No	%	No	%	No	%
Single	165	87.3	430	80.7	1397	87.0	83	100.0	2075	86.1
Semi-Detached	21	11.1	84	15.7	149	9.3	0	0.0	254	10.5
Terrace (1-3 units)	3	1.6	15	2.8	47	2.9	0	0.0	65	2.7
Terrace (>3 units)	0	0.0	4	0.8	13	0.8	0	0.0	17	0.7
Total	189	7.8	533	22.1	1606	66.6	83	3.5	2411	100

Source : Jinjang/Kepong Squatter GIS, 1990

The industrial buildings seem to fare better than the dwelling units. This is because most of the industrial buildings are fairly new and the slightly older buildings are regularly maintained (Table 5.11).

Table 5.11: Uses of Buildings by Condition

Building Use / Condition	Housing No	Housing %	Industry No	Industry %	Commercial No	Commercial %	Public No	Public %	Total No	Total %
New	169	7.9	16	8.2	2	2.9	2	18.2	189	9.8
Moderate	440	20.6	67	34.2	23	32.9	3	27.3	533	22.1
Old	1442	67.6	113	57.6	45	64.3	6	54.5	1606	66.6
Dilapidated	83	3.9	0	0.0	0	0.0	0	0.0	83	3.5
Total	2143	88.5	196	8.1	70	2.9	11	0.5	2411	100

Source : Jinjang/Kepong Squatter GIS, 1990

Houses are typically built of wood and treated with a preservative. Many of the houses are built by private contractors for the owners and the carpentry and workmanship while not elaborate, is sound. Roofs are typically of corrugated tin although more established houses use asbestos or tiles which reduce the potential fire hazards.

The sound condition of the squatter dwellings is also reflected in the generally superior material used for the dwellings in comparison to squatter dwellings in other South East Asia cities. The floor material for the house is generally concrete. The material for the house floor is generally acceptable and does not pose any particular hazards. The most common materials used for walls of squatter dwellings are wood or a mixture of wood and concrete.

Table 5.12: Duration of Stay by Condition of Houses

Duration of Stay / Condition	less than 5 years No	%	5-10 years No	%	11-15 years No	%	more than 15 years No	%	Total No	%
New	80	63.0	61	28.5	4	1.3	24	1.6	169	7.9
Moderate	11	64.7	109	50.9	130	41.1	190	12.9	440	20.6
Old	32	25.2	42	19.6	180	57.0	1188	80.4	1482	67.6
Dilapidated	4	3.1	2	0.9	2	0.6	75	5.1	83	3.9
Total	127	6.0	214	10.0	316	14.8	1477	69.2	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

The above table indicates that there is a positive relationship between the building condition and the duration of stay. Table 5.12 shows that the majority (67%) of the squatters are living in buildings described as "old" and about 80% of them have stayed there for more than 15 years.

(iv) Building Density

Unlike squatter areas in cities of other Asian countries (e.g. Manila, Bangkok, Calcutta and Djakarta) living conditions in the squatter areas of Kuala Lumpur are not unfavourable. The median building density of squatter areas in Kuala Lumpur is 9.1 units per acre (Wehbring, 1976). The mean density in the Jinjang/Kepong squatter area is 16.9 units per hectare (6.8 units per acre) which is lower than the city's average. In relative term there are 93.38 persons per hectare. By comparison, other low-cost housings in Kuala Lumpur, such as, the Pekeliling

City Hall Flat has 360 units per acre and the Cheras Low-Cost Housing Project has 58 units per acre. This indicates the low density in terms of units per acre of the squatter settlement. With the pressure of urban developments in the future, this area needs to be planned in a more orderly way. The improved carrying capacity will help to overcome the problem of lack of land for residential development.

The average size of squatter household used in this study is 5.5 persons per household. This is slightly lower than the household size in Kuala Lumpur which is 5.9 persons (Othman, 1979). The slightly smaller household size is probably because the population are on the average much younger than the average household of the national population. Nevertheless, in the study area, the average population per dwelling unit is higher than the average household size, i.e. 6.2 persons. The survey shows that 12% of the dwellings units have more than one family, averaging to 1.2 households per dwelling unit.

(v) Room Density

Of the total dwelling units, 26% have only one room, while another 43% have two rooms (Table 5.13). 94% of the units have three or fewer rooms, while the remaining 5% have four or more rooms.

Table 5.13: Condition of Buildings by Number of Rooms

Condition / No. of Room	New No	New %	Moderate No	Moderate %	Old No	Old %	Dilapidated No	Dilapidated %	Total No	Total %
One	62	36.7	113	25.7	334	23.2	42	50.6	551	25.8
Two	64	37.9	199	45.2	614	42.6	33	39.7	910	42.6
Three	33	19.5	106	24.1	407	28.2	6	7.2	552	25.9
Four or More	10	5.9	18	4.1	78	5.4	2	2.4	108	5.1
No room	0	0.0	4	0.9	9	0.6	0	0.0	13	0.6
Total	169	7.9	440	20.6	1442	59.8	83	3.9	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

If six persons per house is taken as an average, and a minimum of 3 persons per room is used to determine overcrowding (Malaysian standard of overcrowding (Othman, 1979)), then an average squatter dwelling should have at least two rooms. By this definition 37% of these dwellings are overcrowded. If a two persons per room standard (United Nation's standard for housing in tropical climate (see Ozo, 1990)) is used instead, then 83% of the dwellings can be considered overcrowded.

(vi) Floor Space

Taking into consideration the total floor space of the squatter dwellings will also give some idea of the density of the squatter settlement. The average amount of floor space per person in Jinjang/Kepong area is 189 sq. ft. This is higher than the average amount in some squatter areas and some low-cost housing estates in Kuala Lumpur where the figures are 132 sq.ft and 104 sq.ft. per person respectively (Othman, 1979; Hai, 1976). Since there is no problem of having to obtain permission from building control, the squatters are free to build their house as large as they can afford to. The floor space of the dwelling units is generally lower than that of the industrial buildings.

5.6 Conclusions

One of the major advantages of GIS for planning, especially in areas experiencing rapid change is that, once automated, the combination of digital map and database information allows the decision maker to examine alternative scenarios which take into account both the socio-economic characteristics of squatter settlements and the constraints of physical layout, available area, and land suitability for different kinds of development.

The major obstacle to GIS implementation remains, however, the very large volumes of both cartographic and attribute data that have to be converted into machine-readable form. In addition, the requirements of the planner for addressing the problem of squatters presuppose reasonably accurate maps showing dwelling units and land parcels in each settlement. For the study area, a substantial amount of fieldwork had to be carried out to gather all the information. Only when the database is completed, can further data manipulation and application of the GIS for squatter planning take place.

The Jinjang/Kepong GIS has shown how the former mining land is being used by the squatters. Since there is no proper planning and control, squatter dwelling, industrial and commercial concerns have sprung up haphazardly. Consequently, conflicting mixtures of building uses have emerged, giving rise to uneconomical use of land. The uncontrolled and unplanned squatter settlement makes it difficult to provide proper electricity and water supply. It is even harder to attempt to prevent environmental hazards like flooding as well as to give assistance in the event of fire. The detailed layout of the settlement showing environmental hazard areas is useful for future planning of the area. The Jinjang/Kepong squatter GIS can assist in terms of providing fast and accurate information in a flexible format.

CHAPTER 6

ASSESSMENT OF THE SOCIO-ECONOMIC CHARACTERISTICS AND BASIC NEEDS OF THE JINJANG/KEPONG SQUATTER SETTLEMENT

6.1 Introduction

The primary role of a local authority is to provide services for its local population. If it is to provide these services efficiently and effectively it needs to hold a range of information about the size and socio-economic characteristics of its population. It needs to be able to identify particular areas where there are concentrations of people experiencing different kinds of problems.

In this regard, it is important to investigate and analyse the squatter group in terms of their socio-economic condition as well as their accessibility to facilities required for the satisfaction of their basic needs. This information plays a vital role in evaluating the effectiveness of policy strategies and the effort of the government in bringing about development in the squatter areas.

Data requirements for socio-economic investigation vary with the kind of analysis desired. The use of a GIS package for socio-economic analysis and planning purpose presupposes the availability of certain types of data. The requirements are very extensive in terms of coverage, data integrity, spatial referencing, updateability on a regular basis and level of aggregation.

On account of deficiencies in available up-to-date and reliable information, the prime source for socio-economic analysis of the Jinjang/Kepong squatter settlement was a questionnaire survey. The individual data items were converted to computer compatible form using the INFO facilities in the ARC/INFO software. They were then manipulated and cross-tabulated to form the appropriate tables for socio-economic analysis. The spatial and socio-economic data were used to analyse the current situation as well as to provide scenarios of socio-economic consequences arising from government policies and programmes involved in the development of the squatter area. The demographic aspect of the squatters will first be outlined as a framework for the discussion of their socio-economic characteristics and basic needs.

The discussion on the accessibility of basic services in the Jinjang/Kepong squatter settlement illustrates the use of connectivity functions in a GIS. It has been used to determine the number or type of buildings within a certain distance of a point of service. It has also been used to calculate the number of people within the defined corridor using the STATISTICS function in ARC/INFO.

6.2 Demographic Aspects of the Squatter Community

6.2.1 Population Characteristics

The average size of a Jinjang/Kepong squatter household is 5.5 persons which is slightly higher than the average household size for other squatter settlements in Kuala Lumpur, which is 4.9 (DBKL 1984). This can be attributed to the large number of Chinese people in the area who generally have large families. The Chinese made up 95% of the population, with 81% having more than 5 persons per family. This also implies that the racial composition of the settlement is very homogeneous. This forms the basis for a strong community based political group.

With a figure of 1.13, the area has a higher number of households per dwelling unit than the city average which is 1.1 (DBKL, 1985). Similarly the average number of persons per dwelling unit is also higher than for the city as a whole, i.e. 6.2 and 5.9 respectively. Since the Jinjang/Kepong area is considered to be one of the oldest squatter settlements in the city, it is understandable that the inhabitants tend to have older and bigger families.

More than half (57%) of the dwellings consist of 5-8 persons; 19% have less than 5 persons and 24% have more than 7 persons per dwelling unit. About 5% of the dwellings have more than 10 persons per unit (Table 6.1).

Table 6.1 : Persons per dwelling unit

Persons per house	No of houses	Total Pop	%	Comulative %
1	12	12	0.6	0.6
2	34	68	1.5	2.1
3	100	300	4.7	6.8
4	260	1040	12.2	19.0
5	456	2280	21.4	40.4
6	422	2532	19.8	60.2
7	346	2422	16.2	76.4
8	243	1944	11.4	87.8
9	96	864	4.5	92.3
10	91	910	4.2	96.5
11	19	209	0.9	97.4
12	33	396	1.6	99.0
13	8	104	0.4	99.4
14	6	84	0.3	99.7
15	5	75	0.2	99.9
16	3	48	0.1	100.0
Total	2134	13288	100.0	100.0

Source: Jinjang/Kepong Squatter GIS, 1990

The majority (80%), however, have 4-8 persons per dwelling unit. This explains the reason for building relatively large houses, as discussed in the previous chapter. If the local authority is to provide houses, services or infrastructure to improve the existing situation, information on family and household size should be taken into account.

6.2.2 The Duration of and Reasons for Squatting

As noted above, the Jinjang/Kepong squatter area is one of the oldest squatter settlements in Kuala Lumpur. Its formation can be traced back to the 1950's. After the Japanese Occupation in Malaya, several "new villages" were established, mostly at the edge of the town to prevent communist insurgence. When the new villages' families grew larger, the dwelling units became overcrowded and newly formed families had to find their own way of living. On account of their economic situation and distance to work place, they had to find the most convenient way to build their houses. Their only alternative was to squat on any unused ex-mining land.

In consequence, there is a wide variation in the duration of squatting among the respondents in the area. About 69% of them have squatted for more than 15 years, while another 15% have squatted between 11-15 years. The remaining 16% have squatted for a period of 10 years or less (Table 6.2). In many cases, the duration of squatting is reflected in housing condition. Some 85% of the people who have squatted for more than 15 years live in old and dilapidated conditions (Table 5.11). This implies that very little effort is spent on improving their housing condition. The reasons are either because they cannot afford to do so, or are unwilling to improve because of insecure tenure, since they can be asked to move out at any time by the authorities. However, given the security of tenure, guidance and assistance from the authority, the squatters have generally improved their houses, as in the case of the Kampung Malaysia Tambahan (Diamond et al., 1980; also see Angle, 1983).

Table 6.2: Duration of Stay by Reasons for Squatting

Duration of Stay / Reasons	less than 5 years No	%	5-10 years No	%	11-15 years No	%	more than 15 years No	%	Total No	%
House Ownership	62	48.8	76	35.5	148	46.8	759	51.4	1045	49.0
Proximity to work place	35	27.6	61	28.5	78	24.7	363	24.6	537	25.1
Availability of land	9	7.1	19	8.9	32	10.1	202	13.7	262	12.3
Cheap rent	9	7.1	32	15.0	32	10.1	54	3.6	127	5.9
Staying with relatives	3	2.4	14	6.5	12	3.8	48	3.2	77	3.6
Large compound	2	1.6	6	2.8	7	2.2	27	1.8	42	2.0
Space for gardening	3	2.4	2	0.9	5	1.6	15	1.0	25	1.2
Others	4	3.1	4	1.9	2	0.6	9	0.6	19	0.9
Total	127	6.0	214	10.0	316	14.8	1477	69.2	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

Only a small number of squatters who have stayed for a long time have been able to improve or reconstruct their units. If the locations of good houses are superimposed on the distribution of income, the correspondence with those inhabitants in the upper income bracket is clear, as would be expected.

The rather lengthy period of residence also indicates that there is little upward mobility to allow families to move out of squatter dwellings into conventional housing. Most of the squatters are happy where they are. By having to live in rent-free houses, families can keep their options open and maximise their opportunities to gain future security. Assuming a family of five, expenditure on food alone, on the basis of $2.00 (minimum average cost of basic meal per person per day in Kuala Lumpur (Government of Malaysia, 1990)) per head per day would exceed the monthly income of $300.00. It is obvious that this group of squatters has continued to stay in the area at the expense of cutting down expenditure on food and other necessities. In this light, provision of conventional public housing may not be the appropriate strategy for the bottom category of the low income group (Table 6.3). However, it is likely that only a few squatter families ever make the jump from squatter to standard housing. Since most squatters have low skill levels and insecure jobs with low earnings it is unlikely that they, given the choice, would choose to move elsewhere. Household income is not likely to increase sufficiently to allow the family to move out and buy or rent a place in the open market. At best, moving to better quality housing occurs when squatters are resettled into public housing. However, the rate of public housing production is not sufficiently high to provide housing for the vast majority of squatters.

When the squatters were asked why they squat in the area, the most popular response was that it enabled them to acquire and stay in their own house. Nearly half (49%) of the respondents gave this as their principal reason (Table 6.2). It may reflect the fact that a high priority is given to house ownership. Irrespective of whether the house was officially approved or badly constructed, or whether the land was theirs or not, they would try to construct and stay in their own house.

Basically the poor and rich share a common desire for house ownership. However, the difference is in their ability to achieve that goal, partly because of the differences in their income level as well as the short supply of really low-cost houses which the poor can afford. For this reason, house ownership, even in a squatter area, is an important personal achievement. Hence, it becomes the major reason why the squatters continue to squat in their present location.

This reason for squatting may not explain why the squatters squat initially but rather is an explanation for their continuing to do so. Thus squatters may at first stay in the area as lodgers, because of its proximity to their place of work. Gradually they build their own houses and become more psychologically settled in the area. Even if they change their job to ones which are some distance away from their present residences, their ownership of squatter dwellings may encourage them to remain in the area.

The second most common reason for squatting is proximity to the work place. For low income households, residing near the place of work is important because it means saving on transport fares. Since employers seldom provide accommodation, and since low-cost or low-rent housing is always in short supply, squatting appears to be the logical alternative.

The third reason given by the respondents is the availability of land. This is related to the common desire to own houses, since what is available is not land to be purchased, but rather land that can be used as the location for building houses.

The fourth reason is that the rent is low. This only applies to those who are renting dwelling units or those renting private land which requires them to make some monthly payments. Land and house rents are comparatively cheap when compared to non-squatting areas.

Other reasons include staying with a relative, having a large compound and land availability for gardening. A clearer picture can be shown by cross tabulating the reasons for squatting and the duration of stay in the area. Those who have stayed for more than ten years give the following reasons for staying (in descending order of importance) (i) house ownership; (ii) proximity to work place; and (iii) availability of land. Those who have stayed for a shorter time (5 years or less) tend to stay for reasons of availability of land for gardening and other reasons. As regards gardening, farmers usually grow short-term crops due to insecure tenure status. It appears that there is speculation by the squatters that they may acquire the land after they have stayed there for a period. Indeed, there are cases where the government has awarded land to squatters after they have resided there for a certain length of time (Diamond et al., 1980).

More recently, in an effort to encourage squatters to move to public housing, they were offered the opportunity to buy the houses at a subsidised price (Ali, 1986). Although these steps may seem to encourage more squatters, the government has stepped up its control by preventing new settlements from being established (DBKL, 1984).

6.3 Socio-Economic Characteristics

The squatter community provides the unskilled manpower to sustain the industrial and commercial life of the city. A significant point in terms of employment and income in the study area is the low income level of the majority of the squatter families. This is a clear reflection of the relatively unskilled, poorly paying jobs of the wage earners. Typical jobs among the squatters are factory workers, unskilled labourers, drivers, guards, construction workers, petty traders and hawkers.

Table 6.3: Income Distributions by Occupations

Income ($) / Occupation	less 200		200-399		400-599		600-799		800-999		More than 1000		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Professional	0	0.0	0	0.0	3	0.3	11	3.1	32	15.2	62	54.9	108	5.1
Administrative	1	0.9	0	0.0	11	1.2	8	2.2	12	5.9	9	8.0	41	1.9
Clerical	0	0.0	12	2.8	43	4.7	16	4.5	9	4.3	0	0.0	80	3.8
Sales	5	4.5	43	9.9	84	9.2	107	30.4	49	23.3	30	26.5	318	14.9
Agriculture/ Fisheries	0	0.0	8	1.8	17	1.9	11	3.1	8	3.8	4	3.5	48	2.3
Production	13	11.7	59	13.6	95	10.4	74	21.0	44	21.0	3	2.6	288	13.5
Transport	8	7.2	54	12.5	85	9.3	46	13.1	18	8.6	3	2.7	214	10.0
Defence	0	0.0	0	0.0	21	2.3	8	2.3	1	0.5	0	0.0	30	1.4
Service/ Others	60	54.1	257	59.4	556	60.7	71	20.2	37	17.6	2	1.8	983	46.0
Unemployed	24	21.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	24	1.1
Total	111	5.2	433	20.3	915	42.9	352	16.5	210	9.8	113	5.3	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

If the occupations are categorised into various sectors, it can be seen that the chief employer is the service sector and miscellaneous. Some 46% of the heads of household fall into this category. This is followed by the sales, production and transport sectors (Table 6.3). The least significant employers are the agriculture (2%), defence (1%) and administrative sectors (2%). A significant proportion, 7%, of the squatters are more established in the economy as professional and technical workers or have administrative and managerial positions. They can be broadly categorised as high income earners. This group can be reasonably considered as the "opportunists", speculators or false squatters. They are false in that their conditions do not reflect those of the average squatter. They have enough resources to live elsewhere, but choose to squat because it is cheaper.

A significant number of the squatters are involved in the production sector, indicating the importance of squatter industries as a source of employment. Even though the industries are mixed together with the dwelling units, which in some cases gives rise to pollution, for example, industries producing cement products or potteries, or becomes a nuisance to the people, for example, work and repair shops, it cannot be denied that the industries make a significant contribution, in terms of providing jobs to the squatters. What is needed now, is proper physical planning for the area so as to minimise the negative effects that the industrial firms have on the populace.

The low income level of the squatter households is the most significant factor in understanding their situation. On the whole, the income level for squatter households is distributed from $0 income at one extreme of the continuum, to incomes over $1,000 per month at the other. However, the majority of the households' incomes are concentrated in the middle portion of the continuum, as might be expected, with 70% of the households monthly income being between $300-$699. Only 10% are below this level, while 20% are above it (Table 6.4).

More than half of the squatters (56%) have incomes below the official figure for the city poverty level (DBKL, 1984) of $400 monthly income. Most of them are in the service and miscellaneous sectors. However, the median income of the Jinjang/Kepong households is higher than the

Table 6.4: Condition of Houses by Income Distribution

Housing Condition / Income ($)	New		Moderate		Old		Dilapidated		Total	
	No	%	No	%	No	%	No	%	No	%
Less than 200	1	0.6	13	2.9	66	4.6	31	31.3	111	5.2
200.00-399.00	23	13.6	78	17.7	293	20.3	39	47.0	433	20.3
400.00-599.00	38	22.5	171	38.9	696	48.3	10	12.0	915	42.9
600.00-799.00	33	19.5	95	21.6	222	15.4	2	2.4	352	16.5
800.00-999.00	28	16.6	48	10.9	133	9.2	1	1.2	210	9.8
1000.00/more	46	27.2	35	7.9	32	2.2	0	0.0	113	5.3
Total	169	7.9	440	20.6	1442	67.6	83	3.9	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

average figure for Kuala Lumpur. This is partly a result of the development of industrial activities in nearby areas.

Owing to their low income, squatter families seek to minimise their housing costs. This is the chief reason for squatting. Building squatter houses allows the owner to select forms of land use, building standards and density levels which are less restrictive than those governing the conventional sector (Johnstone, 1983). For those who build their own houses, once the initial costs are met there are no further expenses, except for occasional repairs and replacement. The average cost of squatter houses is between $1500 - $5000, which is largely made up of materials. Squatter houses are generally made of wood, or wood plus concrete for wall material. For flooring, concrete and wood are used by most squatters. With minimal facilities, simple design and material and lack of administrative and planning control, squatter houses are much cheaper to build than formalised low-cost housing (refer to Table 7.7).

The low monthly income is also reflected in the condition of these dwelling units. A high proportion of dilapidated houses (84%) are occupied by families earning less than $400.00 per month (Table 6.4). This is again reflected in the cheap material used for buildings and the inability to improve their houses.

It is estimated (Othman and Taib, 1980) that families are willing to pay approximately 20% of their household income for housing (see Figure 7.8). Poorer families, however, attempt to minimise housing cost by paying between 10-15% of their income. The desire to keep housing costs low is reflected in the experience of resettling squatters into public housing. One of the main reasons for their reluctance to move into public housing is due to the high monthly payments required by the housing agency. This will be further discussed in the next chapter.

6.4 Infrastructure and Services

The main complaint about basic needs and community facilities is the inadequate provision of access (i.e. roads and paths) electricity, water supply, public telephone and recreational facilities. Another problem is the lack of health care provision in the vicinity. This is followed by the dissatisfaction with the distance to the nearest market and shops and the lack of a community hall.

6.4.1 Distance to Work Place and Mode of Transport

In order to minimise the travel cost and time spent in commuting, squatters choose to live as close as possible to their place of work. For the purpose of working, the majority (51%) of the wage earners need to travel up to a radius of 2 miles daily. Another 25% have their work place 4 miles away from home. The remainder are less fortunate in having to travel more than 4 miles to work daily. Nearly 6% of the head of households need to travel even longer distance of more than 10 miles to their work place (Table 6.5). There is a positive relationship between the distance to work place and the income level. Table 6.5 shows that a large proportion of the households earning less than $400 a month travel less than 4 miles to work. On the other hand the higher income group, i.e incomes of more than $800, are willing to travel more than 4 miles from their homes. In a study carried out by the Kuala Lumpur Master Plan Unit (1979), it was shown that almost 20% out of a survey sample of 500 squatters in Kuala Lumpur have to travel more than 7 miles to their work place. This indicates how income opportunities and convenience of housing determine the willingness of wage earners to travel a longer distance.

Table 6.5: Distance to Work Place by Income Distribution

Distance to Work	Less than 2 miles		2-4 miles		4-7 miles		7-10 miles		More than 10 miles		No Transport		Total	
Income ($)	No	%	No	%	No	%	No	%	No	%	No	%	No	%
200/less	76	7.0	10	1.9	7	2.8	2	1.6	1	0.8	15	100.0	111	5.2
200 - 399	254	23.3	112	21.1	44	17.5	11	8.8	12	10.0	0	0.0	433	20.3
400 - 599	457	41.9	263	49.4	100	39.7	58	46.4	37	30.8	0	0.0	915	42.9
600 - 799	175	16.1	81	15.2	47	18.7	26	20.8	23	19.2	0	0.0	352	16.5
800 - 999	77	7.1	51	6.9	41	16.3	21	16.8	20	16.7	0	0.0	210	9.8
1000/more	51	4.7	15	2.8	13	5.2	7	5.6	27	22.5	0	0.0	113	5.3
Total	1090	51.1	532	25.0	252	11.8	125	5.8	120	5.6	15	0.7	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

Another explanation for this is that the squatters might initially have squatted in the settlement due to proximity to the work place, but when they change jobs for various reasons, they may not be able or want to move to new squatting areas because they already possess a house in the present location.

The main mode of travelling to the work place is walking, however this is restricted to short-distance travelling. Nearly 35% of the wage earners only need to walk to work. For most of these the destination is less than 2 miles from their place of residence (Table 6.6).

Table 6.6: Distance to Work Place by Modes of Tranport

Distance (Miles) / Mode	less than 2		2-4		4-7		7-10		More than 10		Need no Transport		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Bus	175	16.1	344	64.7	86	34.1	27	21.6	39	32.5	0	0.0	671	31.4
Walking	737	67.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	737	34.6
Motorcycle	33	3.0	121	22.7	146	57.9	81	64.8	45	37.5	0	0.0	426	20.0
Bicycle	112	10.3	49	9.2	1	0.4	1	0.8	0	0.0	0	0.0	163	7.6
Car	33	3.0	18	3.4	19	7.6	16	12.8	36	30.0	0	0.0	122	5.7
No Transport	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	15	100	15	0.7
Total	1090	51.0	532	24.9	252	11.8	125	5.8	120	5.6	15	0.7	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

Bus is the second most popular means of transport after walking. Some 31% of heads of households rely on bus services for their daily transport. It is comparatively cheap and the services for many parts of the Federal Territory are fairly reliable. The bus is suitable for short distance as well as longer distance travelling for those who do not possess their own means of transport. The main complaint is they have to walk quite a long way to the bus stop since the bus route is only along the main road and there are no bus services within the settlement. Buses are widely used by all income groups. A large proportion of bus users (64%) are however, among those working 2-7 miles away from home.

Motorcycling is the third most common means of transport. 20% rely on motorcycles to go to work. This mode of transport is particularly popular for short and middle distance travelling i.e. between 2-10 miles. The majority who travel between 4-10 miles (67%) use the motorcycle as their mode of transport.

The bicycle is the fourth most popular means of transport. Bicycle is of course cheaper than bus or motorcycle and also less tiring than walking. The main explanation for less reliance on the bicycle than might be expected is traffic congestion on the city's roads together with the lack of cycling lanes on these roads. This makes cycling less attractive and often a hazardous form of travelling. Like motorcycles, bicycles are suitable only for short and middle distance travelling. Most of the squatters cycle less than 4 miles from their homes.

The least used mode of transport is car since the majority of squatters cannot afford to own one. Only 5.7% of the squatters used cars to get to work. The majority of this group travel more than 4 miles from home.

Table 6.7: Mode of transport by Income Distribution

Mode of Transport Income ($)	Bus		Walking		Motorcycle		Bicycle		Car		No Transport		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
200/less	76	3.0	65	8.8	4	0.9	6	3.7	1	0.8	15	100	111	5.2
200 - 399	131	19.5	189	25.2	68	16.0	47	28.8	1	0.8	0	0.0	433	20.3
400 - 599	349	52.0	301	40.8	188	44.1	75	46.0	2	1.6	0	0.0	915	42.9
600 - 799	107	15.9	112	15.2	89	20.9	27	16.6	17	13.9	0	0.0	352	16.5
800 - 999	50	7.5	51	6.9	67	15.7	6	3.7	36	29.5	0	0.0	210	9.8
1000/more	14	2.1	22	3.0	10	2.3	2	1.2	65	53.3	0	0.0	113	5.3
Total	671	31.4	737	34.5	426	20.0	163	7.7	122	5.7	15	0.7	2134	100

Source: Jinjang/Kepong Squatter GIS, 1990

The squatters mode of transport is again reflected in their incomes. Table 6.7 shows that the majority (72%) of low income earners (less than $600) either walk or rely on the bus to go to work. Of those in the upper income group (more than $700), 42% used their own private transport, either motorcycles or a car.

Various means of transport are used by the squatters to get to their destination. Considering their limited resources, most of them are satisfied with their present modes of travelling. However, their main problems are lack of accessibility to the main road, the poor road condition and the long way they have to walk to and from bus stops.

6.4.2 Road Network and Accessibility

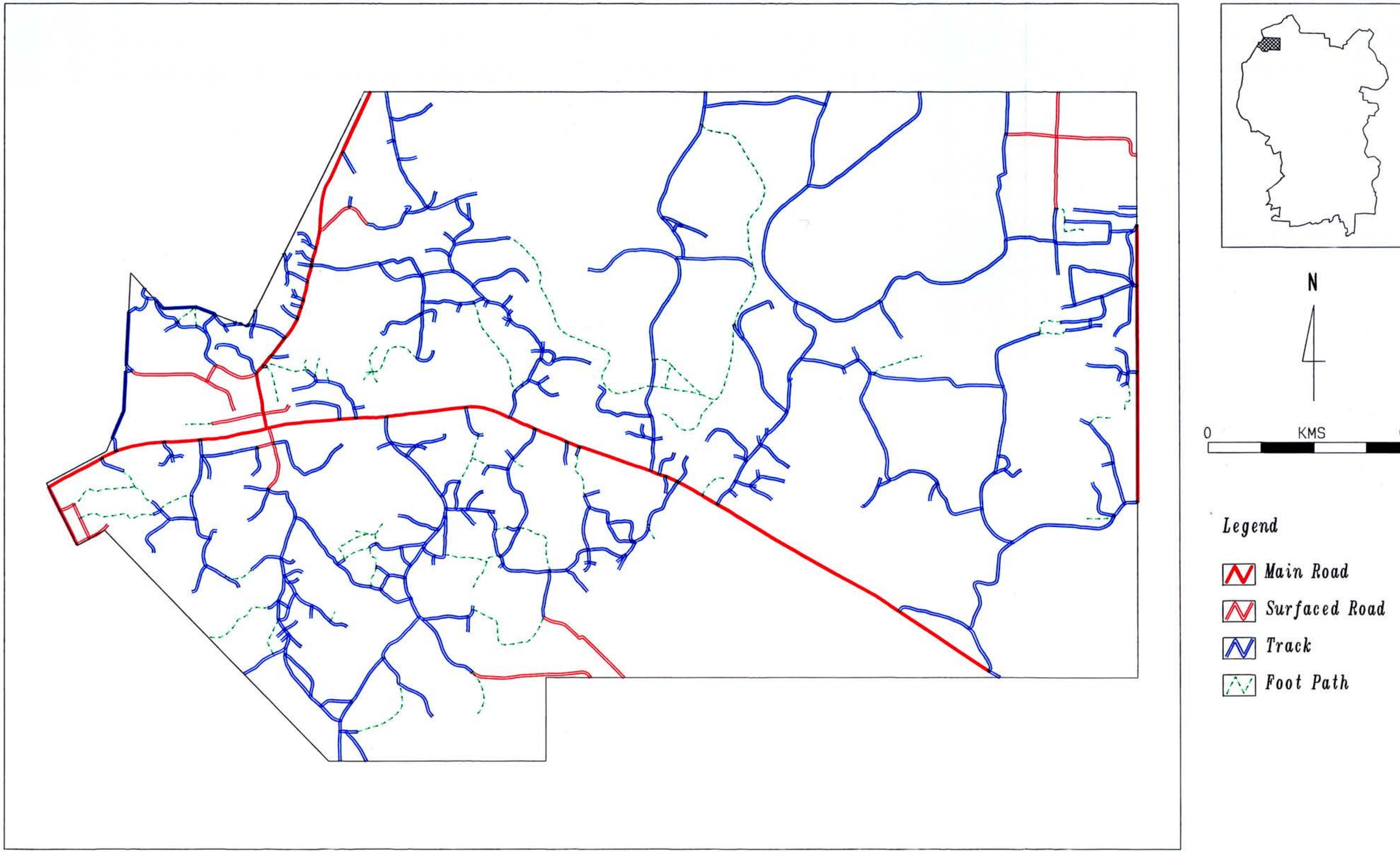
For the Jinjang/Kepong settlement, the Kepong road is a major route for motorised traffic. The road literally divides the area into two sections and becomes the main communication channel to the city centre and other areas. The squatters however, face difficulties as regards the lack of proper access within the settlement to the Kepong road. Other roads within the settlement itself suffer from lack of maintenance and therefore are not used for public access. It should be pointed out that these roads are formerly mining tracks which over the years became more widely used. Some roads which service the shops carry commercial trucks for delivery of goods, but the amount of vehicular traffic is generally limited. The existing tracks are not "macadamised". This often give rise to the problem of the road being slippery and wet during the rainy seasons and may also be a problem in the event of fire or other emergency (Figure 6.1).

Another important network is the footpaths. In the Jinjang/Kepong squatter settlement, where walking is the main means of movement, an intricate network of footpaths has developed, providing access from the houses to place of employment, public meeting places, shops etc. In areas where the drainage is poor, paths and roads tend to be established on the relatively dry land so that accessibility is maintained even during wet periods.

Mining tracks are not properly planned, but the subsequent road network naturally follows the same course. Buildings tend to be built along these roads, although land suitability has also to be considered. On the whole, the squatters attempt to built their houses as close as

JINJANG/KEPONG SQUATTER SETTLEMENT
EXISTING ROAD NETWORK

Figure 6.1



Compiled by Ahris Yaakup on ARC/INFO, July 1990

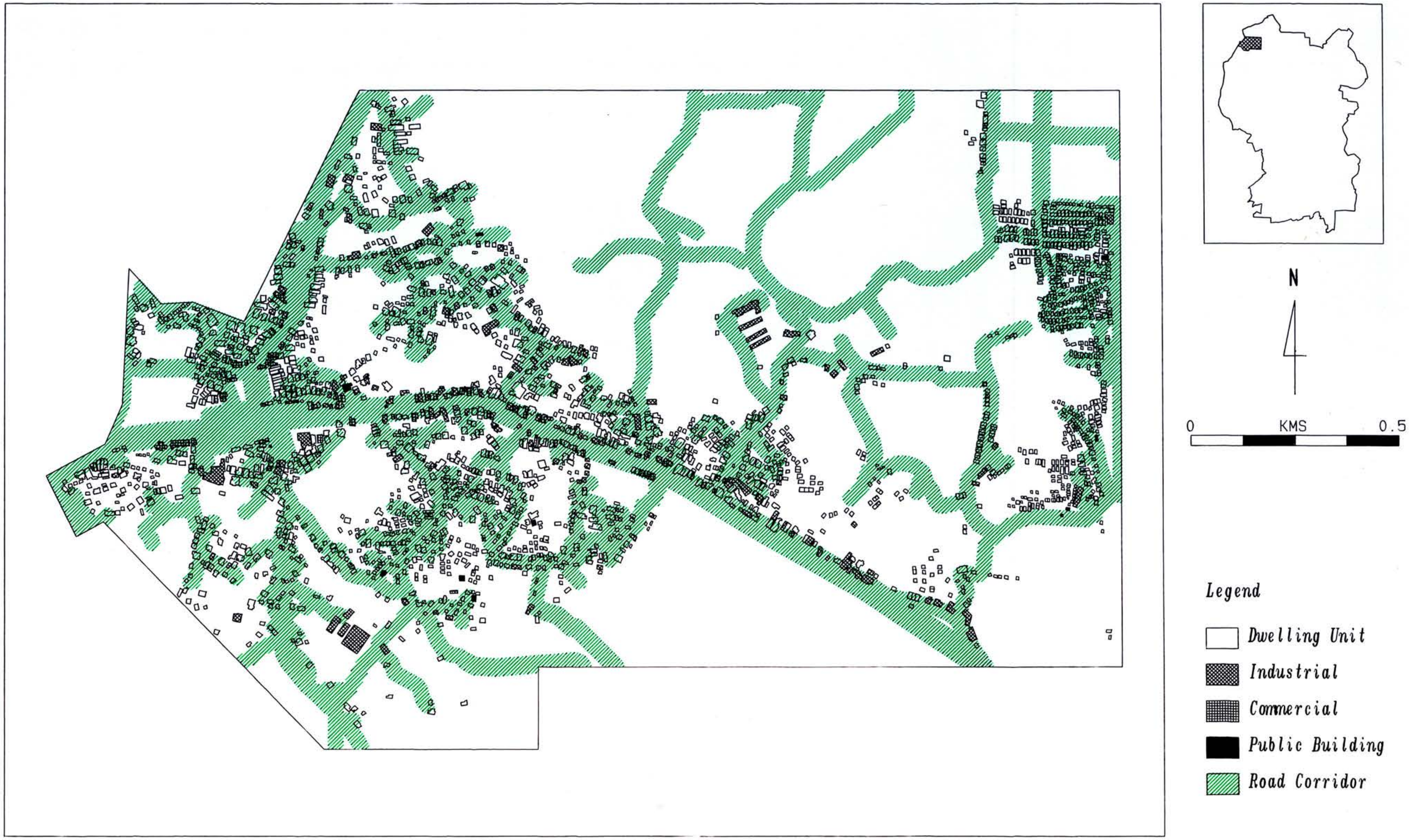
possible to any roads which can be reached by vehicles. The linear housing pattern can also be attributed to a tendency for the roads and footpaths to act as "carriers" for the development of houses.

To examine the problem of accessibility in more detail, the GIS was used to generate a BUFFER of 100 feet from both edges of all roads accessible to vehicles. The coverage was then overlaid with the buildings coverage. It was found that 72% of the buildings were within the BUFFER areas. The necessity of having roads to shops is evident from the coverage which shows that 84% of the total commercial buildings are found within the 100 feet corridor, followed by industrial buildings (84%), public buildings (73%) and houses (73%) (Figure 6.2). It also confirms the notion that most people who used cars (80%) to go to work live within the BUFFER areas. However, another 20% of those who used cars, have to use a footpath to reach their houses.

Since the area is not served by public transport, the users of this form of transport, have to depend on the bus stops along the main Kepong road. For the purpose of measuring the distance and time taken by the squatters to reach the bus stops, BUFFERs were also generated around the bus stops. Taking account of the poor condition and winding nature of the roads, and also the normal high temperatures, a pedestrian would have a speed of approximately 2 miles per hour. Based on that

Figure 6.2

JINJANG/KEPONG SQUATTER SETTLEMENT
BUILDINGS WITHIN ROAD CORRIDOR



Compiled by Ahris Yaakup on ARC/INFO, July 1990

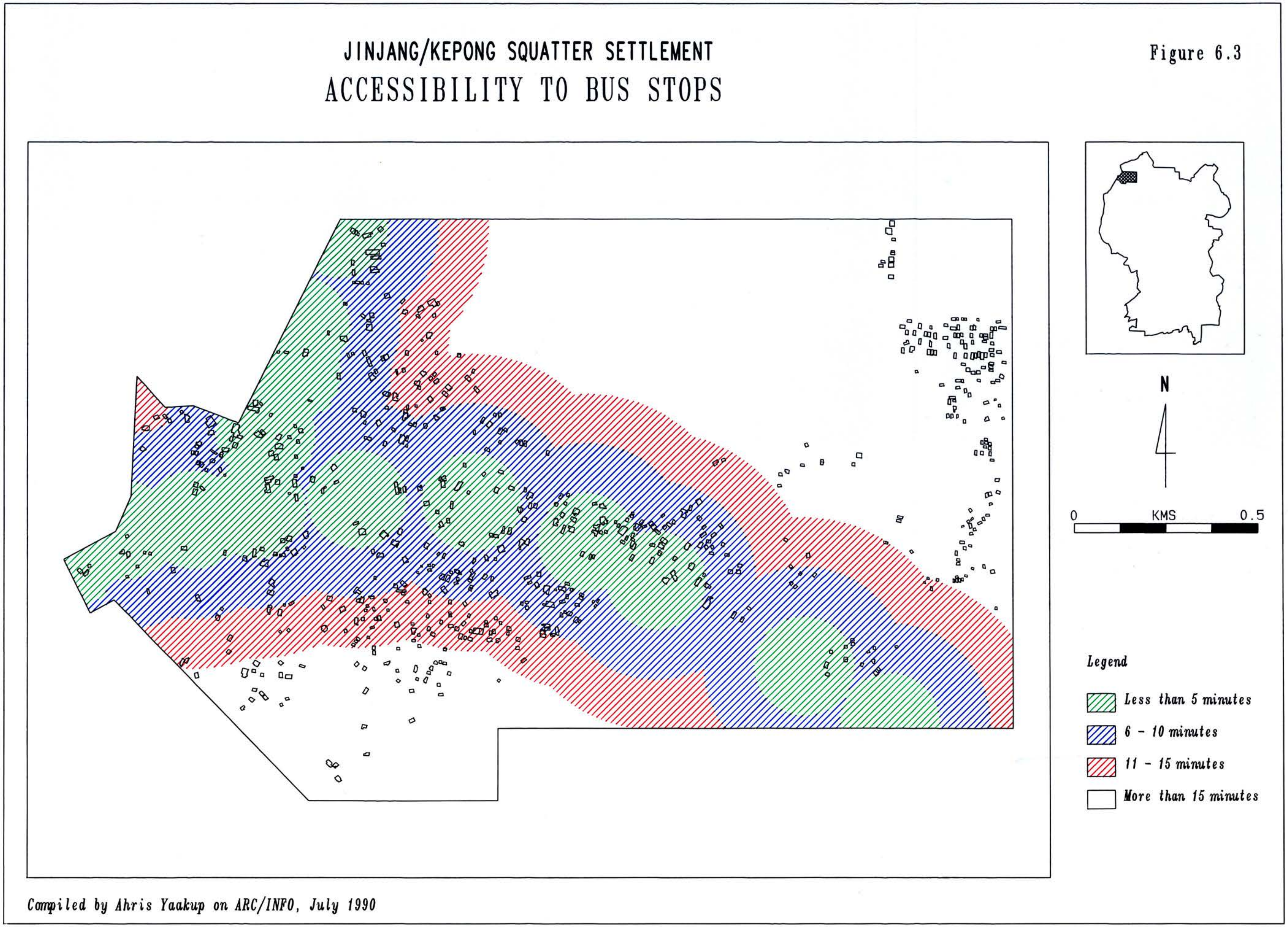
assumption, BUFFERs of 3 different time zones were generated around each bus stop used by the squatters (Figure 6.3). When the coverage was overlaid with a subset of the dwelling units coverage where the head of household depend on the bus to travel to work, it was found that 77% of them live outside the 5 minutes zone. Almost half (46%) of them have to walk for more than 10 minutes to reach the bus stops, while 28% have to walk more than 15 minutes (Table 6.8).

Table 6.8: Time taken for a pedestrians to reach bus stops

Time	No	%	Cumulative	%
Less than 5 mins.	148	22.3	148	22.3
6-10 mins.	219	32.1	367	54.4
11-15 mins	113	17.4	580	71.8
More than 15 mins	191	28.2	671	100.0
Total	671	100.0	671	100.0

Source: Jinjang Kepong Squatter GIS, 1990

The provision and improvement of roads is an important aspect of any upgrading and improvement project for the area. Roads which need improvement, especially those which service a large number of buildings, have to be determined. The improvement or construction of roads should however minimise the number of buildings needing to be destroyed or relocated, at the same time as maximising the number of users. In this way, public transport can then service the area. Also the distance and time taken to reach the present bus stops can be reduced.


JINJANG/KEPONG SQUATTER SETTLEMENT
ACCESSIBILITY TO BUS STOPS
Figure 6.3
N
0
KMS
0.5
Legend
Less than 5 minutes
6 - 10 minutes
11 - 15 minutes
More than 15 minutes
Compiled by Ahris Yaakup on ARC/INFO, July 1990

6.4.3 Public Utilities

The availability of electricity, water supply, a proper sewerage system and rubbish disposal are important minimal conditions which should be present, particularly in urban settlements. Their absence or inadequacy, may influence the health and general condition of the settlements.

To counter such problems, it has become the policy of the City Hall to improve general amenities and facilities in the squatter settlement, especially for those areas proposed for upgrading or improvement and where immediate redevelopment is not intended (DBKL, 1984). This policy has been partly implemented and the effects can be seen in certain parts of the Jinjang/Kepong settlement.

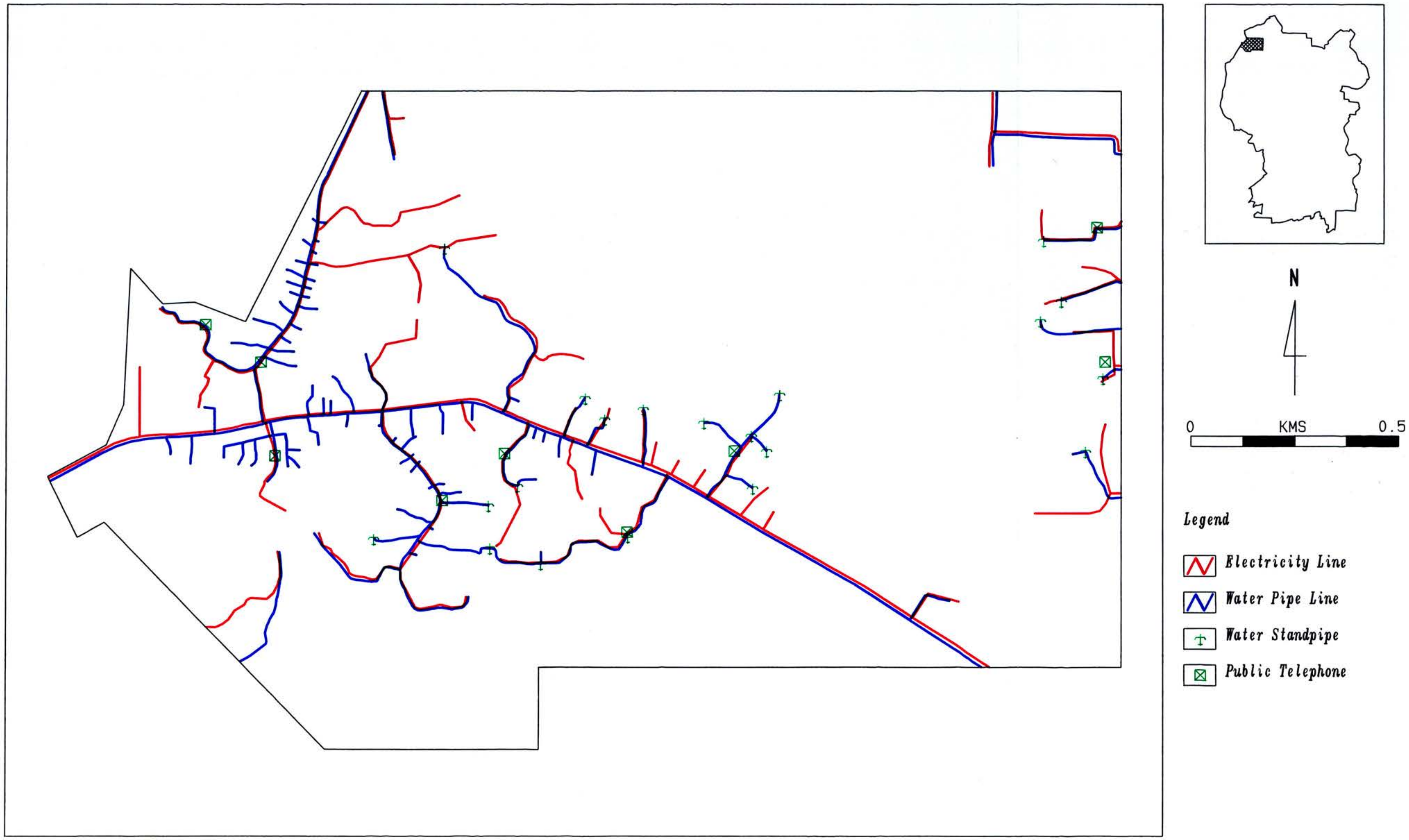
(i) Electricity

Several steps have been taken towards the improvement of electric lines. The main electric lines are found along the main roads to the settlement (Figure 6.4). However, not every household in the area is able to enjoy this facility. To measure the effectiveness and the catchment area of the main electric lines, a BUFFER of 150 feet on both sides of the lines was generated. Any house outside the 150 feet zone was considered to be outside the catchment area (an extra cost of installing electricity lines has to be levied by the National Electricity Board on houses outside the 150 feet zone). It was revealed

JINJANG/KEPONG SQUATTER SETTLEMENT

EXISTING PUBLIC UTILITIES

Figure 6.4



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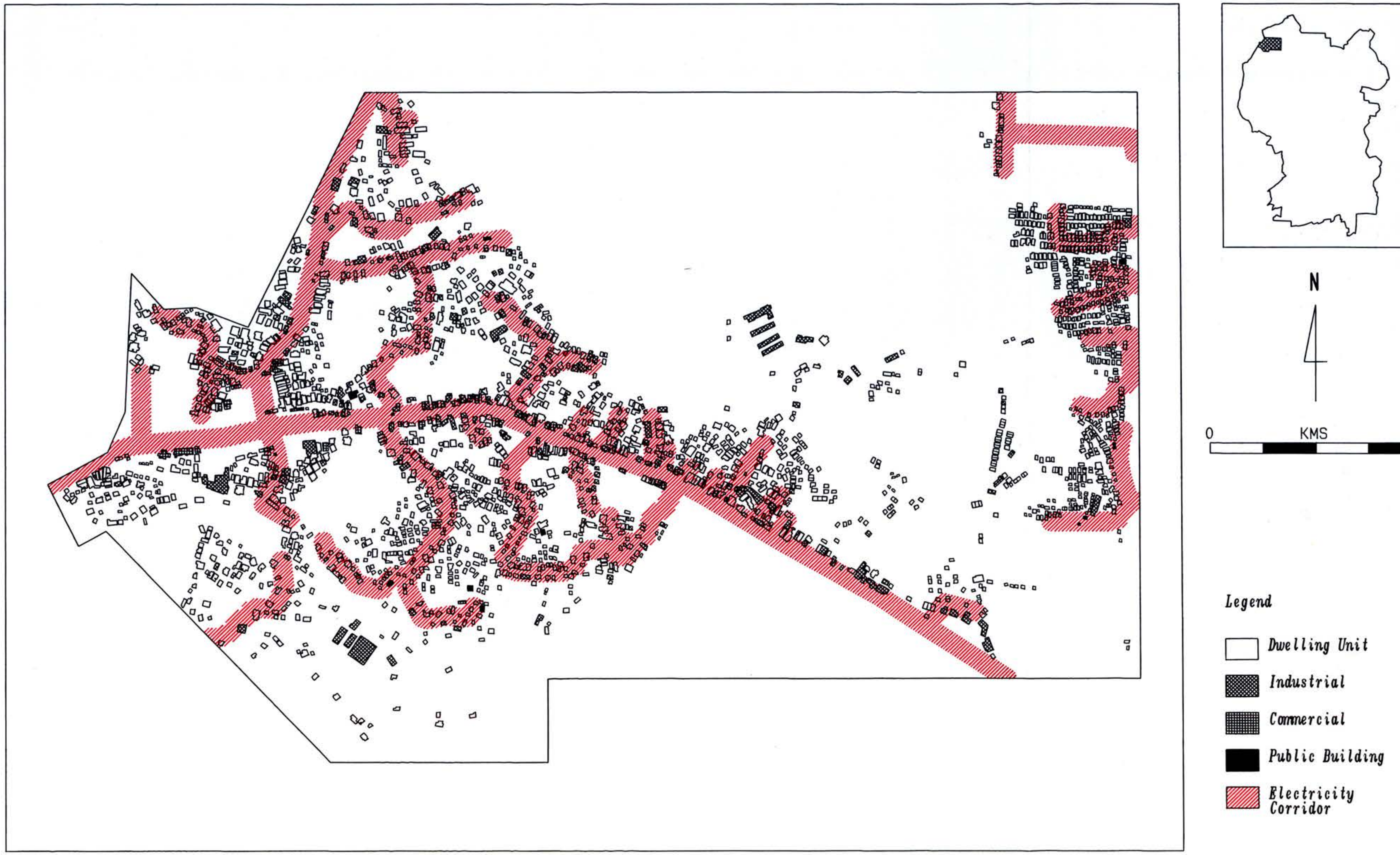
JINJANG/KEPONG SQUATTER SETTLEMENT

Figure 6.5

ACCESSIBILITY TO ELECTRICITY



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that only 40% of the houses were situated inside the 150 feet corridor. Out of the total commercial buildings, 77% are within the corridor, followed by industrial buildings (64%) and public buildings (64%). This would mean that a majority of houses are not easily accessible to the main electric lines (Figure 6.5). If the authority aims to maximise the services to the squatters, they need to improve the electricity network substantially.

(ii) Water Supply

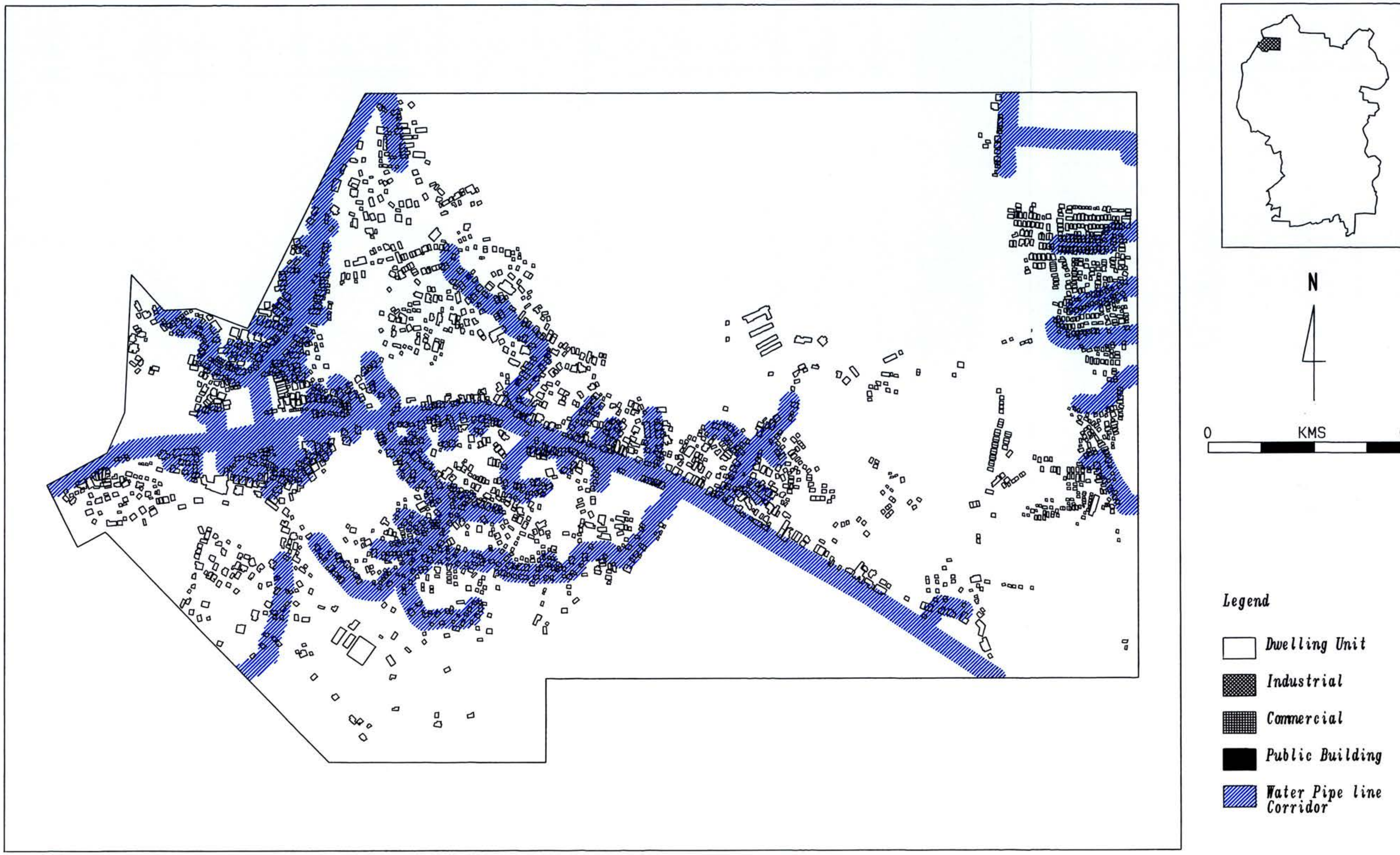
As with the main electricity lines, the water pipelines were also constructed along the main roads to the squatter area. The houses close to the pipelines can easily get piped water. Those living 150 feet away are considered distant from the supply and in such situations, provision of piped water can be costly (distance suggested by the Building Surveyor of City Hall). Based on the 150 feet BUFFER along the main pipelines, it was found that only 42% of the houses were situated within the 150 feet corridor (Figure 6.6). Out of all commercial buildings, 87% were within the area, followed by industrial buildings (55%).

The majority of squatters in Jinjang/Kepong rely on communal standpipes which are installed by the authorities, often at the request of the squatters themselves, for general use. The adequacy of these standpipes depends on the number of households that each

JINJANG/KEPONG SQUATTER SETTLEMENT

Figure 6.6

ACCESSIBILITY TO WATER SUPPLY



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pipe services. If a large number of houses, such as 50 or more units, share one standpipe, then the water supply can be considered inadequate. The accessibility of water supply depends on the distance of the pipes from the squatter houses. If a squatter needs to walk more than 300 feet carrying the water to his/her house, the water supply can be said to be fairly inaccessible to him/her (Othman, 1979). Based on a 300 feet circular BUFFER from standpipe locations, 62% of the houses or 8230 people are found outside the corridor. There are 19 standpipes in the settlement, which gives an average of 57 houses per pipe (Figure 6.7). Often, some form of time table is drawn up to regulate the use of standpipes among the squatters. Plastic hose may also be used to direct the water to individual houses. Inadequacy and inaccessibility of water supply also affect the social atmosphere in the settlement since disputes may occur due to competition for water. The combination of water pipeline corridors (Figure 6.6) and water standpipe zones (Figure 6.7) shows a clearer picture of the situation. When this coverage is overlaid with the dwelling unit coverage, it shows that 56% of houses or 7399 number of people are outside the buffer zone (Figure 6.8). Steps therefore should be taken to improve the situation either by increasing the number of standpipes or making the pipelines more accessible to the people.

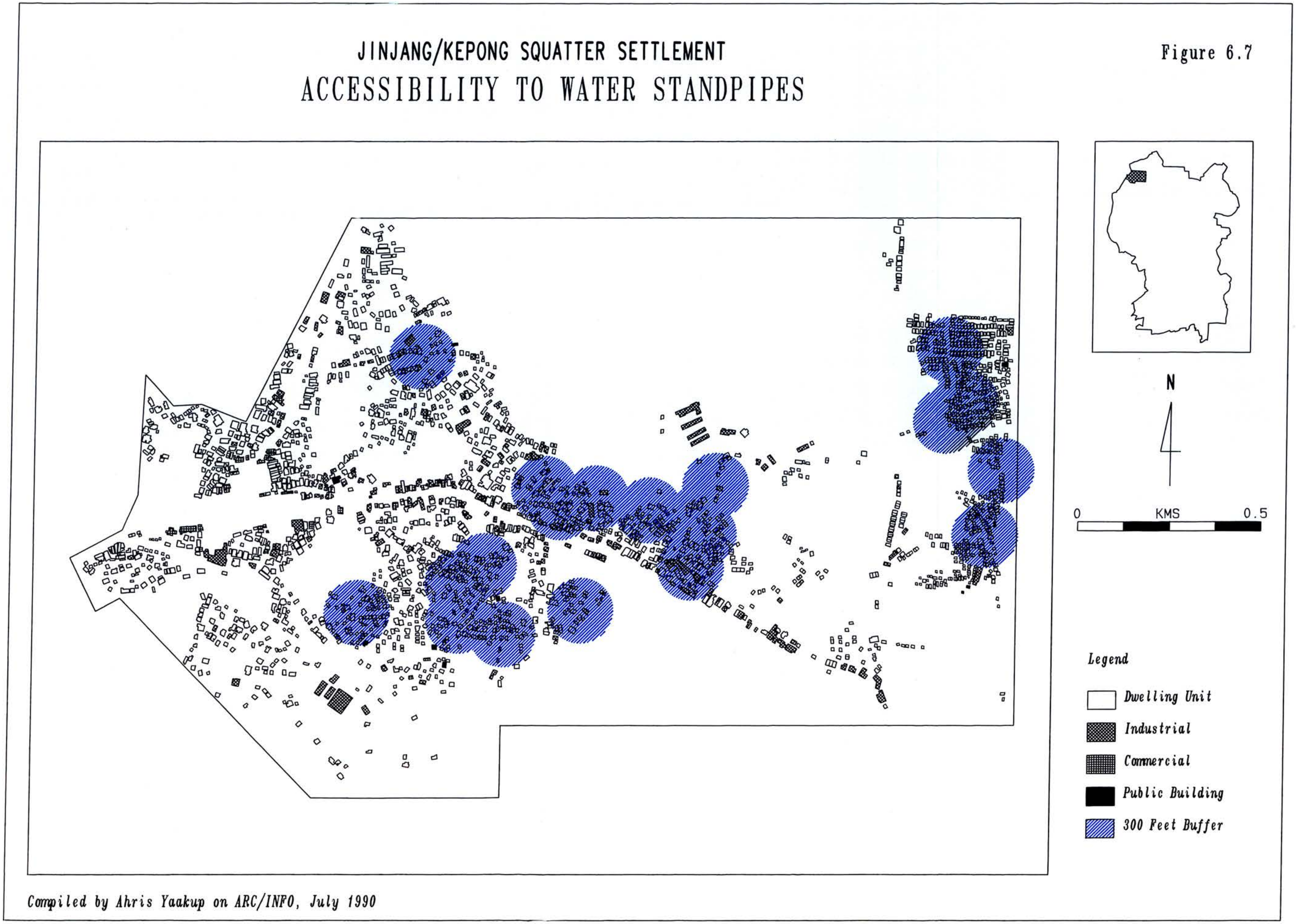
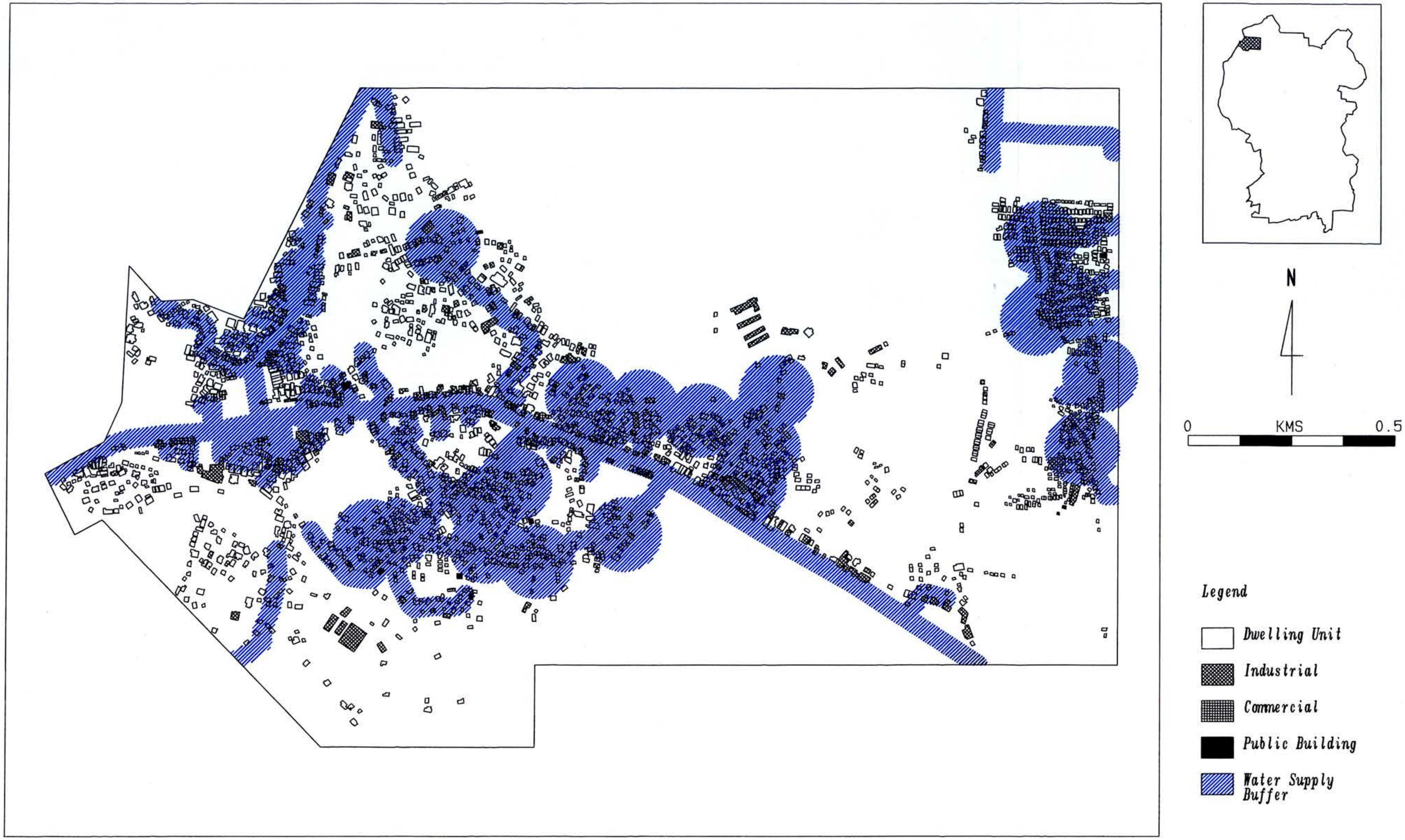


Figure 6.7
JINJANG/KEPONG SQUATTER SETTLEMENT
ACCESSIBILITY TO WATER STANDPIPES
N
0
KMS
0.5
Legend
Dwelling Unit
Industrial
Commercial
Public Building
300 Feet Buffer
Compiled by Ahris Yaakup on ARC/INFO, July 1990

JINJANG/KEPONG SQUATTER SETTLEMENT

ACCESSIBILITY TO WATER STANDPIPES AND PIPELINES

Figure 6.8



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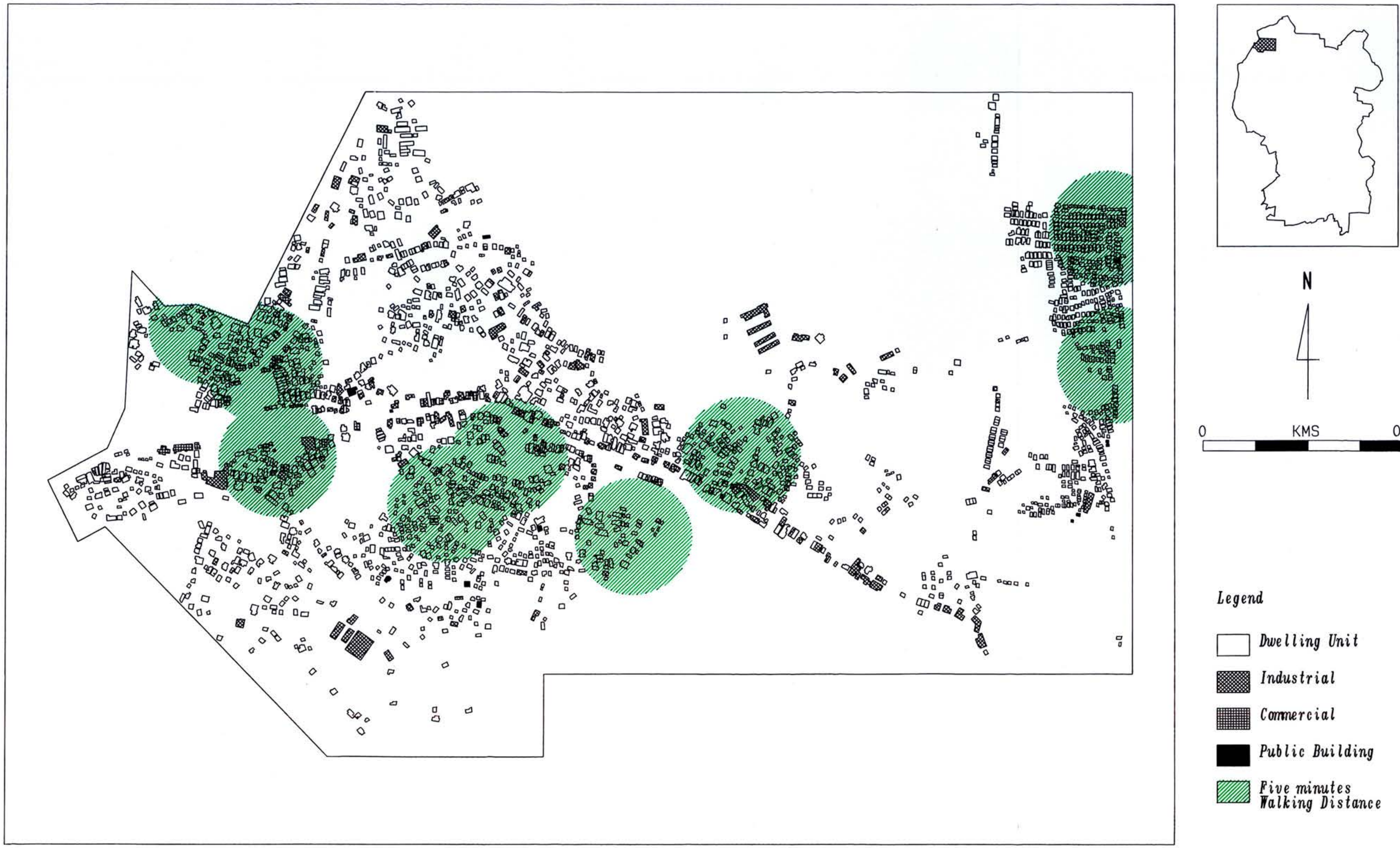
JINJANG/KEPONG SQUATTER SETTLEMENT

ACCESSIBILITY TO PUBLIC TELEPHONES

Figure 6.9



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(iii) Public Telephones

The degree of convenience in using the public telephones in the settlement is far from satisfactory. There are only 9 public telephones to cater for the whole squatter population. Only 38% of houses are situated within 5 minutes walking distance of the telephones (Figure 6.9). Although public telephones may not be as essential as water or electric supply, their importance to the public cannot be denied.

6.5 Assessment of Housing Preference

Squatters' problems may be reduced by improvement and upgrading, redevelopment or relocation programmes alone or by any of these in combination. However, before any action can be taken towards these ends, the squatters existing requirements and future preferences have to be studied. The Jinjang/Kepong squatter GIS also contains information on housing preferences and other associated needs. These types of information will be carried through for further analysis of selected areas for specific programmes.

When individuals were asked about the type of house preferred if they were to be relocated, the most popular choice was the terraced house. This was preferred by 61% of the respondents (Table 6.9). Quite unexpectedly, the second most popular choice was the walk-up flat (1-5 storeys). At 12%, it is however far behind the popularity of the terraced house. The third choice was semi-detached housing (9%), followed by cluster (6%) and detached housing (5%). The most unpopular choice was flats of more than 5 storeys which was acceptable to only 3% of the respondents. Many of the respondents said that given the choice, they did not want flats higher than 5 storeys. However, many of the squatters preferred to stay where they were and did not want to be relocated.

Table 6.9: Housing Preference by Income Category

Income ($) / House Preference	less 200		200-399		400-599		600-799		800-999		More than 1000		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Detached	1	0.9	6	1.4	10	1.1	12	3.4	24	11.4	56	49.6	109	5.1
Semi-detached	1	0.9	6	1.4	30	3.3	49	13.9	78	37.1	36	31.8	200	9.8
Terrace	32	28.8	234	54.0	686	75.0	246	69.9	94	44.8	17	15.0	1309	61.3
Cluster	7	6.3	58	13.4	54	5.9	11	3.1	6	2.9	0	0.0	136	6.4
Flat (1-5 storey)	58	52.3	95	21.9	71	7.7	19	5.3	3	1.4	2	1.8	248	11.6
Flat (6-10 storey)	4	3.6	9	2.1	28	3.1	2	0.6	1	0.5	0	0.0	44	2.0
Flat (11-15 storey)	2	1.8	3	0.7	13	1.4	3	0.9	3	1.4	2	1.8	26	1.2
No Answer	6	5.4	22	5.1	23	2.5	10	2.8	1	0.5	0	0.0	62	2.9
Total	111	5.2	433	20.3	915	42.9	352	16.5	210	9.8	113	5.3	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

The preference for terraced houses was found among all the income categories. Nevertheless, more than half of those within the $200-$799 category preferred the terraced alternative. The largest majority (75%) was among the $400-$599 income group. From general observation of peoples' preference, some variations could be expected to occur in the choice of terraced house between the lower income group who would prefer a single storey house, and the higher income group who would prefer the double storey terraced house. In the study area, the majority of squatters who preferred detached or semi-detached house were within the high income category of $600 or more. On the other hand, the preference for clusters and flats (1-5 storeys) was highest for those earning less than $400 (Table 6.9). Flats were very unpopular among the higher income group while flats of more than 15 storeys were the least popular among all squatters.

(i) Preferred House Price

Successful planning for squatter rehousing can only be made if the squatters' conception of the cost of the house and the level of payment they can afford to make, are taken into consideration. "Low-cost" housing is so labelled in comparison with expensive houses of over $100,000 and the middle range houses costing between $40,000-$80,000. Within this framework houses costing less than $40,000 are often regarded as "low-cost". Not surprisingly that which is termed "low-cost" for the general population turns out to be "high-cost" for the low income group.

As indicated earlier, terraced houses are the most popular choice expressed by the squatters. However, their conception of the lowcost terrace house is much lower

Table 6.10: Types of Preferred Houses by Range of Preferred Price

House Preference / Price Preference($)	Detached		Semi-Detached		Terrace		Cluster		Flat 1		Flat 2		Flat 3		No Answer		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
5000 or less	0	0.0	0	0.0	1	0.1	1	0.7	5	2.0	1	2.3	0	0.0	0	0.0	8	0.4
5001-10000	0	0.0	1	0.5	26	2.0	13	9.6	44	17.7	1	2.3	1	3.8	5	8.1	91	4.2
10001-15000	2	1.8	4	2.0	158	12.1	38	27.9	83	33.5	5	11.4	2	7.7	15	24.2	307	14.4
15001-20000	9	8.3	20	10.0	617	47.1	52	38.2	66	26.6	21	47.7	13	50.0	30	48.4	828	38.8
20001-25000	2	1.8	21	10.5	185	14.1	15	11.0	21	8.5	8	18.2	1	3.8	3	4.8	256	12.0
25001-30000	9	8.3	41	20.5	142	10.8	6	4.4	14	5.7	0	0.0	1	3.8	4	6.5	217	10.2
30001-35000	9	8.3	29	14.5	99	7.5	4	3.0	4	1.6	2	4.5	3	11.6	2	3.2	152	7.1
35001 or more	73	67.0	77	38.5	51	4.0	2	1.5	3	1.2	0	0.0	3	11.6	0	0.0	209	9.0
No Answer	5	4.5	7	3.5	30	2.3	5	3.7	8	3.2	6	13.6	2	7.7	3	4.8	66	3.1
Total	109	100	200	100	1309	100	136	100	248	100	44	100	26	100	62	100	2134	100

Source: Jinjang/Kepong Squatter GIS, 1990

than the current price of available housing units. Some 73% of those who prefer terrace houses expect them to cost between $10,000-$25,000. Only 14% are prepared to pay more than $30,000. The rest are prepared to pay between $25,000-$30,000 for a terraced house (Table 6.10).

Those who want to buy semi-detached houses are generally prepared to pay more for these units. From the Table 6.11, 74% of them expect the unit to cost more than $25.000, while 39% of these people are prepared to pay more than $35.000 for a semi-detached. As regards squatters who prefer detached houses, 29% priced them between $10,000-$25,000. However, 67% expect the detached house to cost more than $35,000.

Overall, only 0.4% expect the houses to cost less than $5,000. The majority (75%) are prepared to pay between $10,000 and $30,000. For those earning less than $200 per month, more than half can only afford to buy houses which do not cost more than $5,000 per unit (Table 6.11).

Table 6.11: Range of Preferred House Price for Different Income Categories

Income ($) / Price Preference($)	less 200 No	%	200-399 No	%	400-599 No	%	600-799 No	%	800-999 No	%	More than 1000 No	%	Total No	%
5000 or less	7	6.3	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0	8	0.4
5001-10000	35	31.6	47	10.9	6	0.7	3	0.9	0	0.0	0	0.0	91	4.3
10001-15000	22	19.8	235	54.3	42	4.6	3	0.0	4	1.9	1	0.9	307	14.4
15001-20000	32	28.8	111	25.6	626	68.4	44	12.5	9	4.3	6	5.3	828	38.8
20001-25000	6	5.4	19	4.4	170	18.6	53	15.0	7	3.3	1	0.9	256	12.0
25001-30000	0	0.0	5	1.1	20	2.2	156	44.3	33	15.7	3	2.6	217	10.1
30001-35000	1	0.9	6	1.4	12	1.3	66	18.7	60	28.6	7	6.2	152	7.1
35001 or more	0	0.0	3	0.7	5	0.5	18	5.1	90	42.9	93	82.3	209	9.8
No Answer	8	7.2	7	1.6	34	3.7	8	2.3	7	3.3	2	1.8	66	3.1
Total	111	5.2	433	20.3	915	42.9	352	16.5	210	9.8	113	5.3	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

The majority (80%) of those earning between $200 and $400 are willing to pay between $10,000-$20,000 for a house. Houses costing more than $35,000 are popular among the income group of more than $800 a month.

(iii) Preference for number of rooms

On the whole, the squatters prefer their houses to have 2 or 3 rooms. From Table 6.12, it is apparent that 27% of them prefer two bedroom units while 60% prefer three bedroom units. Only 2% want a one bedroom units. The remaining 8.5% plan to purchase four bedroom houses.

As regards the number of rooms and housing type, the most popular was the 2-3 bedroom terraced house. Among the demand for flats, 44% preferred two bedroom flats. For those who preferred a one bedroom dwelling, the popular

Table 6.12: Types of House Preferred by Number of Rooms Preferred

House Preference / Room Preference	Detach		Semi-Detach		Terrace		Cluster		Flat 1 (1-5)		Flat 2 (6-10)		Flat 3 (11-15)		No Answer		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
One	3	2.7	4	2.0	16	1.2	2	1.3	14	5.7	2	4.5	1	3.9	0	0.0	42	2.0
Two	20	18.3	47	23.5	340	26.0	31	22.8	108	43.6	9	20.5	7	26.9	12	19.4	574	26.9
Three	68	62.4	117	58.5	817	62.4	83	61.1	104	41.9	26	59.1	14	53.8	34	54.8	1263	59.2
Four or more	9	8.3	24	12.0	117	8.9	13	9.6	12	4.8	2	4.5	2	7.7	3	4.8	182	8.5
No Answer	9	8.3	8	4.0	19	1.5	7	5.2	10	4.0	5	11.4	2	7.7	13	21.0	73	3.4
Total	109	5.1	200	61.3	136	6.4	248	11.6	44	2.1	44	2.1	26	1.2	62	2.9	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

choice was the flat. For those who preferred detached and semi-detached units, the most popular types were either 3 or 4 or more bedrooms.

Table 6.13: Groups of Occupancy by Number of Rooms Preferred

Groups of Occupancy / Room Preference	1-4		5-8		9-12		13 or more		Total	
	No	%	No	%	No	%	No	%	No	%
One	31	7.6	10	0.7	1	0.4	0	0.0	42	2.0
Two	296	72.9	265	18.1	9	3.8	4	18.2	574	26.9
Three	76	18.7	1030	70.2	149	62.3	8	36.4	1263	59.2
Four or More	1	0.2	97	6.6	74	31.0	10	45.6	182	8.5
No room	2	0.5	65	4.4	6	2.5	0	0.0	73	3.4
Total	405	19.0	1467	68.8	239	11.2	22	1.0	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

The preferred number of rooms per dwelling reflects the household size of the respondent. The majority (73%) of households in the 1-4 person category preferred two room dwellings. For those households consisting of more than 4 persons, 3 room houses were the most popular choice. Even for households with more than 9 persons, 3 rooms was considered adequate by the majority (Table 6.13).

(iii) Preferred Location

When the squatters were asked about their perception of being squatters in the Jinjang/Kepong area, many of them expressed the view that they did not mind being squatters. Most of them were happy with the place and well satisfied with the community. In fact, given the choice, many would want to continue to settle there.

However, if they were asked to be relocated, the majority (80%) preferred to stay within 3 miles of their existing settlement.

Table 6.14: Preferred Location (From present settlement) by Distance to Work Place

Preferred Location(mile)	Within 3		Outside 3		No Answer		Total	
Distance to Work Place(mile)	No	%	No	%	No	%	No	%
Less than 2	1035	60.3	47	11.9	8	38.1	1090	51.1
2-4	451	26.3	76	19.1	5	23.8	532	24.9
4-7	151	8.8	95	23.9	6	28.6	252	11.8
7-10	38	2.2	87	21.9	0	0.0	125	5.9
More than 10	27	1.6	91	22.9	2	9.5	120	5.6
Not working	14	0.8	1	0.3	0	0.0	15	0.7
Total	1716	80.4	397	18.6	21	1.0	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

The rest indicated that they were willing to go wherever the government placed them. Apart from considerations like closeness to friends and an established community, an essential factor in choosing the place to stay was proximity to the work place (Table 6.14). About 87% of the squatters who preferred to stay within 3 miles of their existing settlement were those currently working within 4 miles of home. Some 60% had their work place less than 2 miles from home. The majority of those who were willing to move outside a 3 mile radius had their work place more than 4 miles from home. They were mainly in the upper income group.

iv) The Preferred Method of Housing Development

With regard to the method of housing development, 66% of the squatters preferred already developed land with completed units. The majority in this group (82%) preferred to stay within 3 miles of their present settlement. This seems to indicate their willingness to improve and accept the policy to upgrade their living condition provided that they be given a chance to buy a decent house within their limited range of affordability. Only 22% preferred the government to provide them with an existing plot of land. On their part they were willing to build the houses themselves. The remaining 11% preferred the site and service method whereby they would be provided with the core house which they could improve on later. In general, more than half (54%) preferred to have ready made houses within 3 miles of the existing settlement (Table 6.15).

Table 6.15: Preferred Locations (from existing settlement) by Preferred Methods of Housing Development

Preferred Location(mile) / Preferred Method	Within 3		Outside 3		No Answer		Total	
	No	%	No	%	No	%	No	%
Ready Made	1149	67.0	249	62.7	6	28.6	1404	65.8
Half Ready	192	11.2	43	10.8	3	14.3	238	11.0
Site/Land	36	21.4	103	25.9	8	38.1	478	22.4
No Answer	8	0.5	2	0.5	4	19.0	14	0.7
Total	1716	80.4	397	18.6	21	1.0	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

Examining whether the above preference are related to income, the majority of those who chose the site and services method are in the \$600-\$800 income bracket.

Table 6.16: Preferred Method (for housing Development) by Income Category

Income ($) / Preferred Method	less 200		200-399		400-599		600-799		800-999		More than 1000		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Ready Made	88	79.3	297	68.6	602	65.8	221	62.8	134	63.8	62	54.9	1404	65.8
Half Built	6	5.4	36	8.3	101	11.0	52	14.8	25	11.9	18	15.9	238	11.1
Site/Land	17	15.3	96	22.1	207	22.6	76	21.6	49	23.3	33	29.2	478	22.4
No Answer	0	0.0	4	1.0	5	0.6	3	0.8	2	1.0	0	0.0	14	0.7
Total	111	5.2	433	20.3	915	42.9	352	16.5	210	9.8	113	5.3	2134	100

Source : Jinjang/Kepong Squatter GIS, 1990

Among the higher income group, a large proportion preferred to have a plot of land provided by the government (Table 6.16). Considering their ability to get houses outside the squatter area, this group appears to be opportunist. They seem to take advantage of the situation by hoping that they will be given land which will be relatively low priced.

6.6 Conclusions

In the squatter GIS, every cartographic element is linked to an associated database of attributes which is carried through all the stages of analysis. This enables the assessment of the squatters' existing situation in terms of their demographic and socio-economic characteristics and their basic needs.

It is obvious, that the physical and socio-economic situation of the Jinjang/Kepong squatter settlement, is quite favourable compared to squatter settlements in other cities of South-East Asia. Nevertheless, the present uneconomic use of squatters' land cannot continue further because of the pressure of urban development. Such conflict requires detailed planning programmes to be carried out.

The study area is one of the longest established settlements in the city. The majority of its inhabitants have stayed there for more than 15 years, mainly for reasons house ownership, accessibility to work place and land availability. They tried to obtain cheap accommodation and stayed as close as possible to their work places which are scattered in and around the area. Most of them walked to their place of work while others depended on public transport. As such they spent only a minimal sum of money for housing and travelling costs were greatly reduced. These are necessary measures since most of them rely on low paying unskilled jobs, mainly general factory work. Nonetheless, there are some so called "opportunist" groups with relatively high earnings which would enable them to move to standard housing, if they so desired.

The government attempted to improve their living conditions by bringing in main public utilities such as electric and water supply. However, the current provisions are far from satisfactory especially in term of their accessibility. More than half of the population do not have easy access to roads, electricity or water supply or public telephones. If the area is to be upgraded, attention should be focused on improving the condition of the roads and extending the utility networks.

As the consequence of continuing pressure from urban development and increased demand for housing, it is essential that relocation programmes are carried out in certain areas of the settlement, in addition to improvement exercises in other areas. The analysis revealed that most squatters preferred completed houses rather than plots of land. The preferred houses are 3 room terraced to accommodate large families of 4-8 people.

It is obvious that the squatters eventually want to improve their living condition by moving to more comfortable standard houses, but in many cases they are largely hampered by their low income. The cost of their preferred houses in the open market are, however, beyond their expectations. The squatters requirements and the pressures of urban land development are two essential factors which must be taken into consideration by the authority, in order to formulate future policies and programmes for the area.

CHAPTER 7

THE IMPACT OF DEVELOPMENT PROPOSALS ON THE JINJANG/KEPONG SQUATTER SETTLEMENT

7.1 Introduction

In the Malaysian planning system, the local plan, as a part of the overall development plan, is intended to provide local authorities with a definitive means of setting out policies and proposals for the development and other use of land within their areas. The development proposals for the study area have been formulated by the Jinjang local plan. In line with the requirements of the continuous approach to planning (discussed in Chapter 3) it is necessary to consider these proposals in the light of the issues raised in Chapter 5 and 6. Using traditional methods, the consequences of these proposals can only be indicated in a general way, however, with the Jinjang/Kepong GIS the detailed scenarios resulting from the proposals can be clearly seen. The polygon overlay function in ARC/INFO is widely used in this chapter to analyse the consequences of development proposals on the study area. The authority's development proposals for the area will be translated into a physical plan, and overlaying it with the squatter buildings database. The major concern of this chapter will be to study the resulting scenarios.

Against this background, this chapter (i) outlines the development proposals for the Jinjang/Kepong area as set out by the Jinjang/Kepong local plan, with emphasis on housing proposals; and (2) it analyses the impact of development proposals as well as the resulting scenarios on the Jinjang/Kepong squatter settlement.

7.2 Development Proposals for the Jinjang Planning Unit

According to the non-statutory Jinjang local plan (refer to Appendix D for the background to the Jinjang Planning Unit), there are 1726 acres of land which have not been developed in the area (DBKL, 1987, p.7). These form 33% of the total area and are expected to fulfill land requirements for development until the year 2000. The Jinjang Planning Unit will be developed to cater for its population of 185,000 people. A total of 83,000 new jobs are forecast and these will be centred in area with the highest potential for development.

The local plan implies that areas which have the highest development potential are those which have not yet been developed for urban activities. These include ex-mining land, vacant land and the existing squatter area. Based on the present orientation of development, any future urban activities will inevitably involve these areas. As regards housing, the Jinjang local plan aimed to provide housing units affordable by the people and sufficient to meet the targetted population (DBKL, 1987, p.29) i.e. 185,000 people by the year 2000.

Based on the above premise, in the period 1987-2000 this planning unit requires 21,020 new housing units. This number of units is estimated to be sufficient to meet the requirements for additional households, replacement of old units and rehousing of squatters.

Housing units which are currently being built and those that have already been approved to be built will total 11,253 units. Therefore the remaining 12,650 units will have to be built to meet the target. The local authority plan to locate the new housing estate in areas which now are occupied by the squatters together with the ex-mining land and vacant land. The present stock of low-cost houses is far from satisfactory. Low-cost units form only 4.2% of the current housing stock. At present, only 2070 units or 18.4% of the 11,253 houses which are being built or will be built are low-cost. It is thus essential that the local plan takes effect in full to motivate the provision of 58% of the total as low-cost houses in line with the housing target of the Kuala Lumpur structure plan.

7.3 The Impact of Development Proposals on the Jinjang/Kepong Squatter Settlement

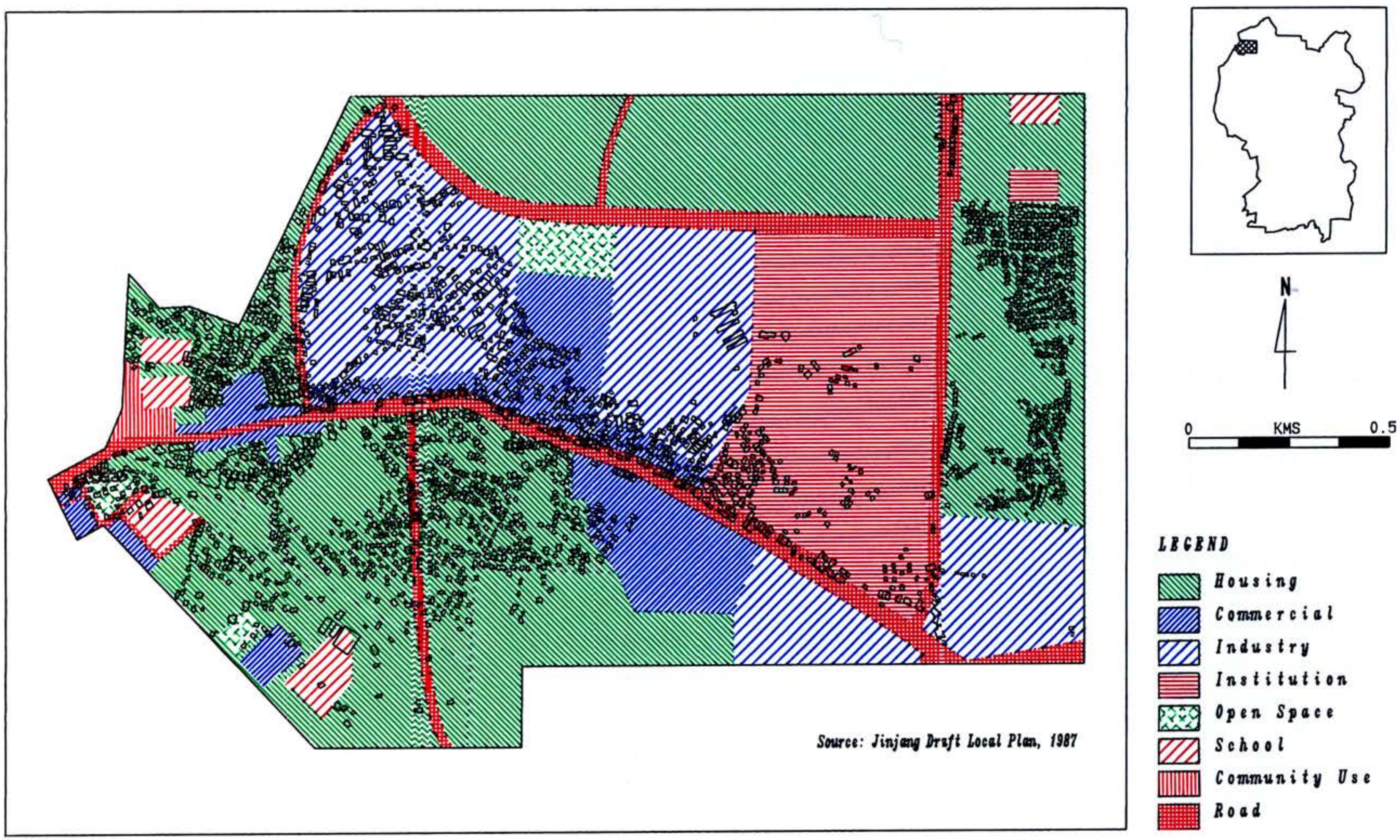
For the purpose of assessing the implications of the above development proposals on the squatters settlement, the land use proposals were "translated" on to the study area. The information was transformed into computer compatible format by digitizing the proposed land use zoning and putting in the various attributes, for example the status of development, identified developers and development phases. This information was derived not only from the local plan but also gathered from the Town Planning Department of the City Hall, as well as the various agencies involved in the preparation and implementation of the future projects in the area.

7.3.1 Proposed Land Use

The land use proposal is anticipated to have a direct impact on the squatter settlement. Based on the manipulation of the database, it is found that 360 hectares of the study area have the potential for future development. This allocation is expected to accommodate 5 main uses, namely housing, industry, commercial, institutional, open space and community use (Figure 7.1). An area of 110 hectares will be allocated for housing which is expected to have a density of 160 units per hectare. This would mean that the present density of squatter settlement which is 94 units per hectare will have to be increased to 160 units per hectare, so as to meet the housing requirement by the year 2000. In addition, the local authority will have to allocate adequate area for community facilities.

Figure 7.1

JINJANG/KEPONG SQUATTER SETTLEMENT
PLANNED LAND USE



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It should be noted that the Jinjang Planning Unit is the most important industrial area in Kuala Lumpur. This area contributes 27% of the total industrial growth and 24% of the industrial workforce of the city (DBKL, 1986). Of the industries, 74% are motor workshops and light manufacturing industries. Most of these are small scale, employing less than 50 workers.

About 75% of the existing industries in the squatter area operate in shop houses and dwelling units. Such a situation gives rise to traffic congestion and in many cases, disturbance to the housing environment. Further, the houses are exposed to fire and health hazards. In view of this situation the local authority propose to have a planned industrial area in Jinjang/Kepong. An area of 46 hectares has been allocated to accommodate these industries. The proposed acreage will not only meet the squatter industries space requirement but should be able to cater for the expected industrial expansion by the year 2000. The local plan also recommends that the new industrial area be provided with adequate infrastructure, social and landscape facilities such as a shopping centre, playing area, bus terminal, parking area, etc.

In order to realise the aim of Jinjang/Kepong to become the local centre, a commercial zone is also planned for the area. The existing squatter shops will be located in this zone in addition to other commercial enterprises by the year 2000.

It is quite apparent that the development proposals will largely involve the site which is now occupied by the squatters. If the proposals are implemented, major land use change can be expected. Essentially, the squatters will have to be relocated to make room for the various land uses, especially those of an industrial kind. Nevertheless, several advantages can be expected from the proposals, mainly the employment opportunities and perhaps an improved socio-economic situation for the workers. Further, since the industrial site will be in close proximity to the houses, the journey to work place can be greatly reduced. However, the implication of such a development will be that a large number of squatters will have to be relocated. Table 7.1 illustrates the number of squatter buildings affected by the change of use.

Table 7.1: Types of Affected Existing Squatter Buildings by Types of Proposed Land Use

Existing Building / Proposed Land Use	Housing No.	Housing %	Industry No.	Industry %	Commercial No.	Commercial %	Public No.	Public %	Total No.	Total %
Housing	1343	57.9	66	26.7	42	50.0	9	81.8	1460	54.8
Commercial	206	8.9	48	19.4	20	23.8	1	9.1	275	10.3
Industry	351	15.1	54	21.9	1	1.2	1	9.1	407	15.3
Institution	160	6.9	23	9.4	1	1.2	0	0.0	184	6.9
Community	26	1.1	2	0.8	0	0.0	0	0.0	28	1.1
Road reserve	189	8.1	50	20.2	20	23.8	0	0.0	259	9.7
Open Space	45	1.9	4	1.6	0	0.0	0	0.0	49	1.8
Total	2320	100	247	100	84	100	11	100	2662	100

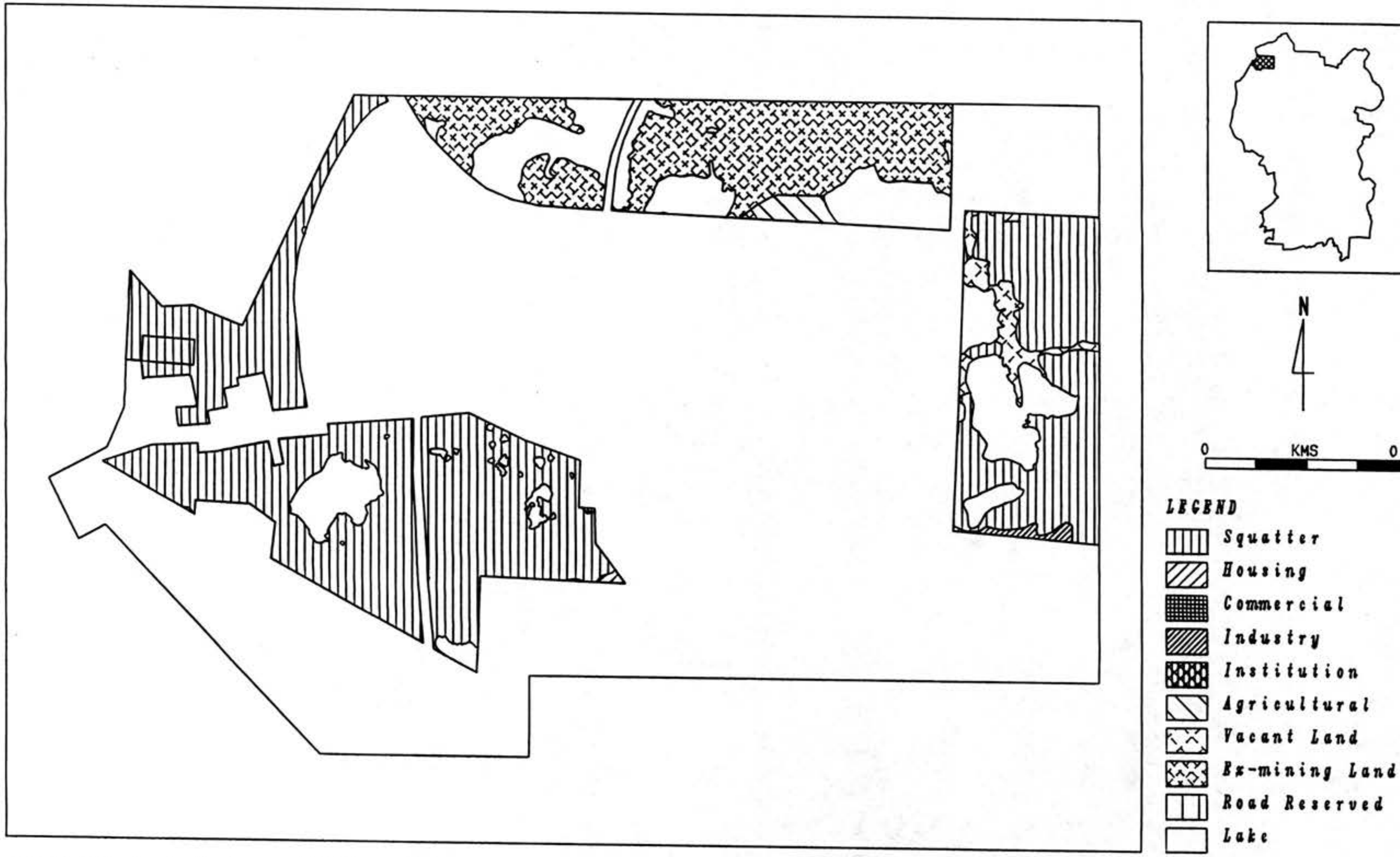
Source: Jinjang/Kepong Squatter GIS, 1990

For housing, the proposed acreage of 110 hectares is sufficient to accommodate 17,600 people (based on the

JINJANG/KEPONG SQUATTER SETTLEMENT

CURRENT LAND USE ON SITE PROPOSED FOR HOUSING DEVELOPMENT

Figure 7.2



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local plan's proposed density of 160 persons per hectare). This would mean that all the squatters could be relocated into the proposed houses in addition to new households. However, if the land use proposal is overlaid on the existing land use, much of the proposed site for housing falls on the ex-mining, mining pool and vacant land (Figure 7.2). Consequently, this proposal would require massive land reclamation.

7.3.2 Status of Land Use Development

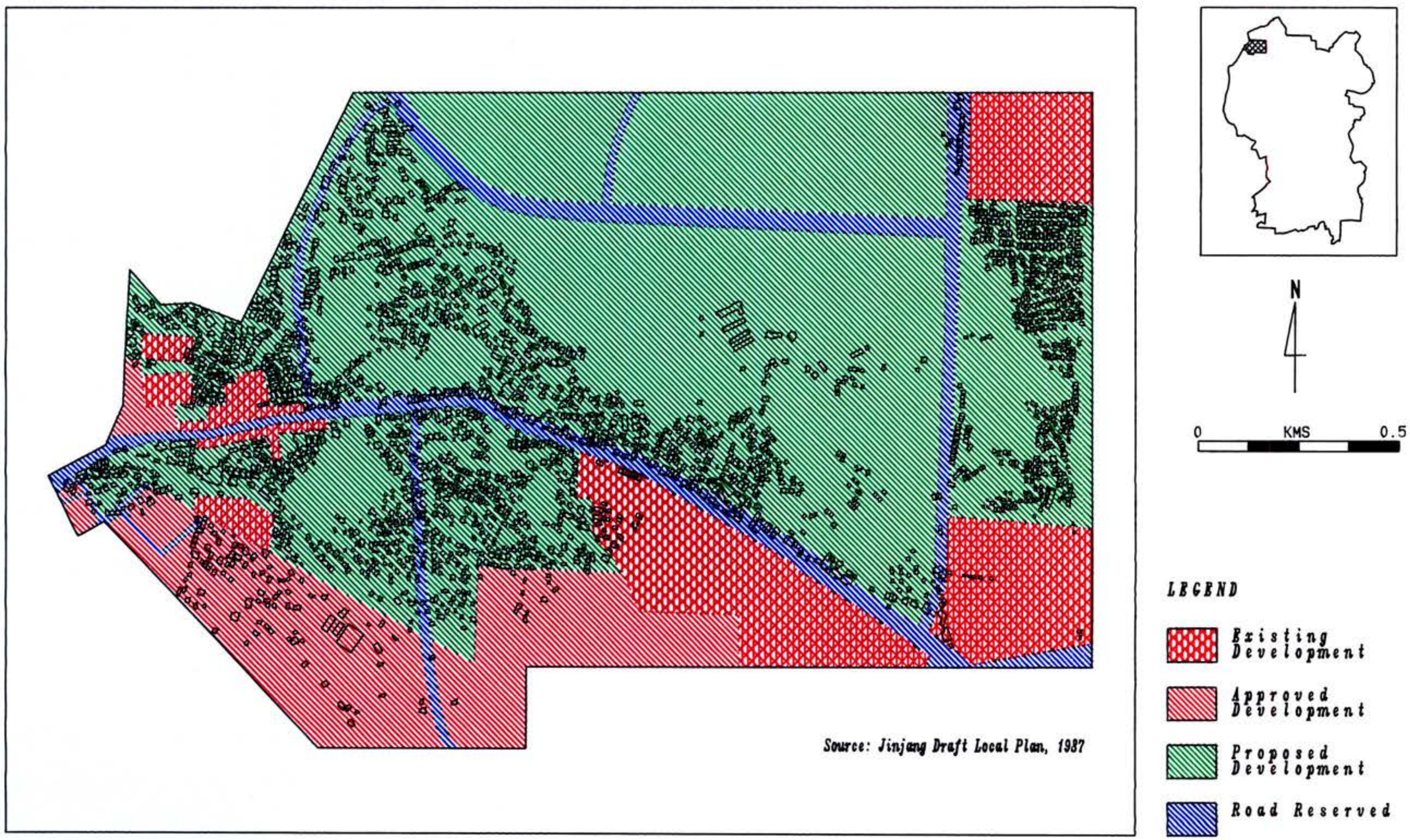
For the purpose of monitoring land use development, the development proposals can be divided into 3 classes i.e. existing, approved and proposed development (Figure 7.3). Each of these classes of development will now be examined, to determine how it affects different parts of the existing squatter settlement.

(i) Existing Development

The existing development involves 45 hectares, comprising 14% of the study area. The area consists of housing, commercial and industrial buildings which should not be confused with squatter erected buildings, since they have already been approved by the authority. Nevertheless the study has revealed that there are squatters who live on vacant land in between existing developments (Figure 7.3). In all there are 48 houses, 8 industrial buildings

Figure 7.3

JINJANG/KEPONG SQUATTER SETTLEMENT
STATUS OF DEVELOPMENT



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and 8 commercial buildings of this type, which make up 2.4% of the total squatter buildings. It is therefore crucial for the local authority to formulate immediate relocation programmes for these squatters, either in temporary or other types of housing.

(ii) Approved Development

Approved development refers to the development proposals which have already been given consent by the authority. Approval will also have been given to the development layout and development orders, will have also been issued to the developers. Approved development involves an area of 42 hectares, which is 13% of the study area. In terms of planning, this status will only require monitoring to ensure that the approved development will take place. At present, most approved development sites have already been cleared and some have been levelled. Nevertheless there are still some remaining squatter buildings, especially on the fringes of the area. Altogether there are 122 houses and 11 commercial buildings which make up 5.1% of the total squatter buildings.

(iii) Proposed Developments

Proposed developments are those that have been identified as having the potential for development. They cover the ex-mining area, vacant land and the existing squatter areas. An area of 213 hectares or 65% of the study area has been designated for future development. At present, the local authority plan is for mixed development of houses, shops and industries in the area. Nevertheless, details of the layout have not been decided. The study reveals that 2160 squatters buildings, or 82.8% of the total, will be affected (Table 7.2). Implementation of these proposals would certainly have an adverse affect on the majority of the squatters.

The above study has shown the various implications of different types of development. It has been revealed that there are still squatter buildings in areas that have already been developed, as well as in sites approved for development. This implies a partial failure of the present programme to face the actual situation, which is perhaps more complex than it seems. The authority should

Table 7.2: Types of Affected Existing Squatter Buildings by Status of Development

Existing building / Development Status	Housing No	Housing %	Industry No	Industry %	Commercial No	Commercial %	Public No	Public %	Total No	Total %
Existing development	48	2.1	8	3.4	8	9.6	0	0.0	64	2.4
Approved development	122	5.3	11	4.6	0	0.0	0	0.0	133	5.1
Proposed development	1927	84.3	167	70.8	55	66.3	11	100	2160	82.8
Road reserve	189	8.3	50	21.2	20	24.1	0	0.0	259	9.9
Total	2286	100	236	100	83	100	11	100	2616	100

Source: Jinjang/Kepong Squatter GIS, 1990

design specific programmes to deal with the squatters in existing and approved development areas, as well as the squatters in the proposed development areas. In other words, because the squatter problem is dynamic in nature, the planning approach should be more adaptive towards its changing needs.

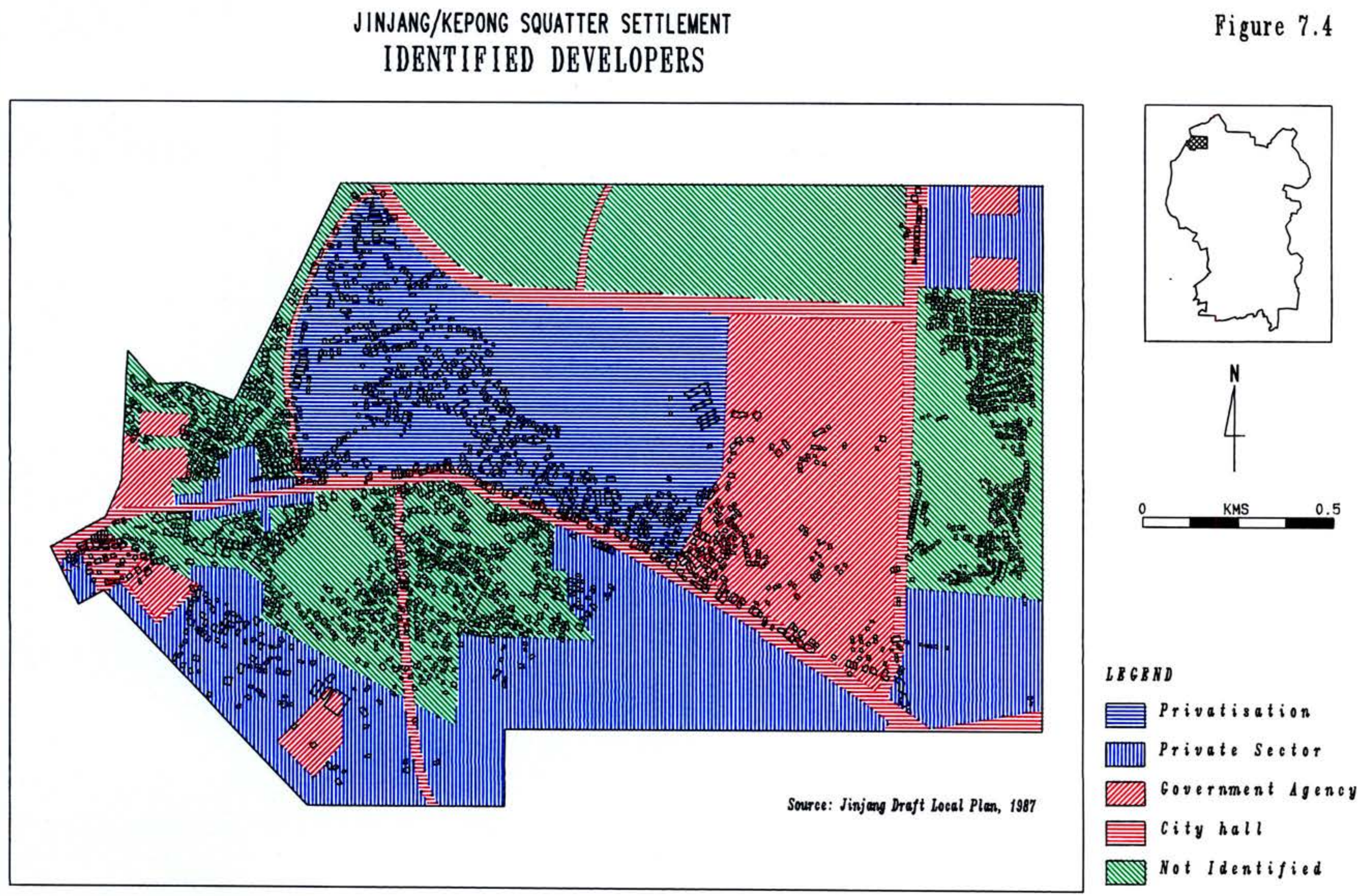
7.3.3 Identified Developers

The information on the potential developers for the various projects in the study area is based on the land records, the approved planning applications and various applications to develop any part of the area. It should be realised that the process for developing a site occupied by squatters is different from that for vacant land. The developers of land currently occupied by squatters are responsible for resettlement of the squatters (Hai, 1976). They have to formulate programmes for the squatters to enable the development to take place. The developers usually have their own ways of dealing with this problem (Diamond et al., 1980). The three main groups of developers are the private sector, government agencies and joint ventures between private sector concerns and the government. This last is commonly referred to as the privatisation approach (Figure 7.4).

(i) Private Developers

An area of 78 hectares is going to be developed by the

Figure 7.4



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private sector. The area will be put to various uses including housing, industrial and commercial, in accordance with the planning approval issued by the City Hall. There are 172 squatter buildings in the allotted area and they will become the private developers'

Table 7.3: Types of Affected Squatter Buildings by Types of Identified Developers

Existing building / Identified Developer	Housing		Industry		Commercial		Public		Total	
	No	%	No	%	No	%	No	%	No	%
City Hall	210	9.2	50	21.2	20	23.8	0	0.0	280	10.7
Private	145	6.4	19	8.1	8	9.5	0	0.0	172	6.6
Privatisation	489	21.4	85	36.0	13	15.5	2	18.2	589	22.5
Government Agencies	186	8.2	25	10.6	1	1.2	0	0.0	212	8.1
Not decided	1251	54.0	57	24.2	42	50.0	9	81.8	1359	52.0
Total	2281	100	236	100	84	100	11	100	2612	100

Source: Jinjang/Kepong Squatter GIS, 1990

responsibility (Table 7.3). The authority do not specify what actions should be taken by the developers with regard to the squatters. However, past experience has shown that most squatters will be offered the option to purchase low-cost houses, either to be built as part of the development in question or in other areas of the city, at subsidised prices.

(ii) Privatisation Projects

In line with the privatisation concepts adopted by the Malaysian government, the Kuala Lumpur local authority envisaged and facilitated a greater involvement of the private sector in achieving its objectives (DBKL, 1987). It was also envisaged that fiscal and monetary policies would be used as instruments to complement planning policies and direct growth along the lines of the selected strategies.

The prime objective for introducing the privatisation concept was to reduce the financial burden as well as the administrative responsibility of government agencies in providing facilities to the people. The concept, which was introduced in 1983, was also employed to accelerate growth through investment by the private sector.

In accordance with the concept, the private sector is required to provide the public facilities which were previously the responsibility of the local authority. The facilities include schools, sport centres, community halls, recreation and other related facilities. In the Federal Territory, the concept has been applied in various housing, commercial, industrial and recreational developments (DBKL, 1989).

In the study area, a total of 63 hectares have been allocated to the private sector to be developed for industrial and commercial concerns. In return, the developer is required to assist the government in solving problems such as, the relocation of squatters and the provision of both infrastructure and public facilities. The privatisation projects involve 23% of squatter buildings, 589 in all. The majority are houses (489) while the rest are industrial, commercial and public buildings (Table 7.3).

The government has agreed that the squatters who will be affected by the privatisation programmes are guaranteed resettlement on the following terms (DBKL, 1989):

1 Each family will be offered the purchase of one low-cost house;

2 They will be located in temporary housing in rent-free long houses or City Hall owned flats, before moving to permanent housing.

To ensure the success of the programme, the land allocation has been conducted meticulously. Among the conditions of the land allocation are:

1 Land is allocated at low premium;

2 Land is allocated to developers that have been identified as economically sound;

3 Land is allocated with certain provisions to suit requirements of the privatised projects. For example, in the study area, privatisation is only used for industrial projects;

4 Land title is transferred to the developer and can be used as collateral;

5 As an incentive, flexible terms are given to the developer for the provision of infrastructure and public facilities.

Every developer who is awarded a project is subject to the conditions that he/she should assist the government in solving a number of problems or in achieving certain objectives, for example:

1 Alleviation of the squatters' resettlement problems;

2 Provision of low-cost houses;

3 Provision of infrastructure, public utilities and recreational facilities;

4 Provision of sites for new industries or relocation of existing industries.

The various administrative agencies are also requested to give assistance to ensure the smooth running of the projects. The agencies include the City Hall, the Land Office of the Federal Territory and the Regional Development Division of the Prime Minister's Department. The privatised projects are expected to be regularly monitored to ensure their success.

(iii) Development by Government Agency

At present, an area of 49 hectares is reserved for future use by a government institution. There is no specific plan for the proposal yet. A detailed study will have to be carried out if the area is to be developed. The agency concerned will also have to solve the problems associated with the 212 squatter buildings in the area.

(iv) City Hall

City Hall is responsible for developing the proposed road network in the study area. At present there are 280 squatter buildings (11%) situated along the road reserve. City Hall will acquire the land when the road is to be constructed and it will have to formulate a specific programme for the squatters before road construction is begun.

(v) Areas where developers are not yet identified

An area of 110 hectares is also reserved for future development. The only specification for the area is that it will be developed for housing at a density of 160 people per hectare. The authority has neither identified who is going to develop the land nor the type of houses to be built. A majority of the squatters live in the area in question, which contains 1359 squatter buildings. The authority should have a detailed plan of actions for the squatters if the area is to be developed.

Table 7.4: Socio-economic Scenarios for Existing Squatters Involved in Proposed Resettlement Programmes by Types of Developers

Scenarios / Developer	Family No	Family %	Population No	Population %	Income less than $600 No	Income less than $600 % *	Walking Dist. more than 2mls. No	Walking Dist. more than 2mls. % *	Dwelling Unit No	Dwelling Unit %
Private	168	6.6	950	6.7	107	73.8	94	64.8	145	6.4
Privatisation	550	21.9	3087	21.7	363	74.2	241	49.7	489	21.4
City Hall	235	9.3	1278	9.0	133	63.3	119	56.7	210	9.2
Government	217	8.6	1220	8.6	133	71.5	101	54.3	186	8.2
Not Identified	1366	53.9	7698	54.1	821	65.6	603	48.1	1251	54.8
Total	2536	100	14233	100	1557	68.2	1158	50.8	2281	100

Note: * % of households
Source: Jinjang/Kepong Squatter GIS, 1990.

Having examined the various potential developers, it is possible to use the database to illustrate the resulting socio-economic scenarios for the squatter households (Table 7.4). About 70% of the squatters involved in the proposed resettlement programme have income of less than $600 per month, and the majority of this group have to travel more than 2 mile to their work place. These factors should be given consideration in the plan of action for the affected squatters. It is also apparent that the privatisation project will have a major role in the resettlement programme since its project will involve nearly 22% of the squatter population. However, it should also be realised that no specific programme (since the developer has not been identified) has so far been drawn up for more than 50% of the squatter population.

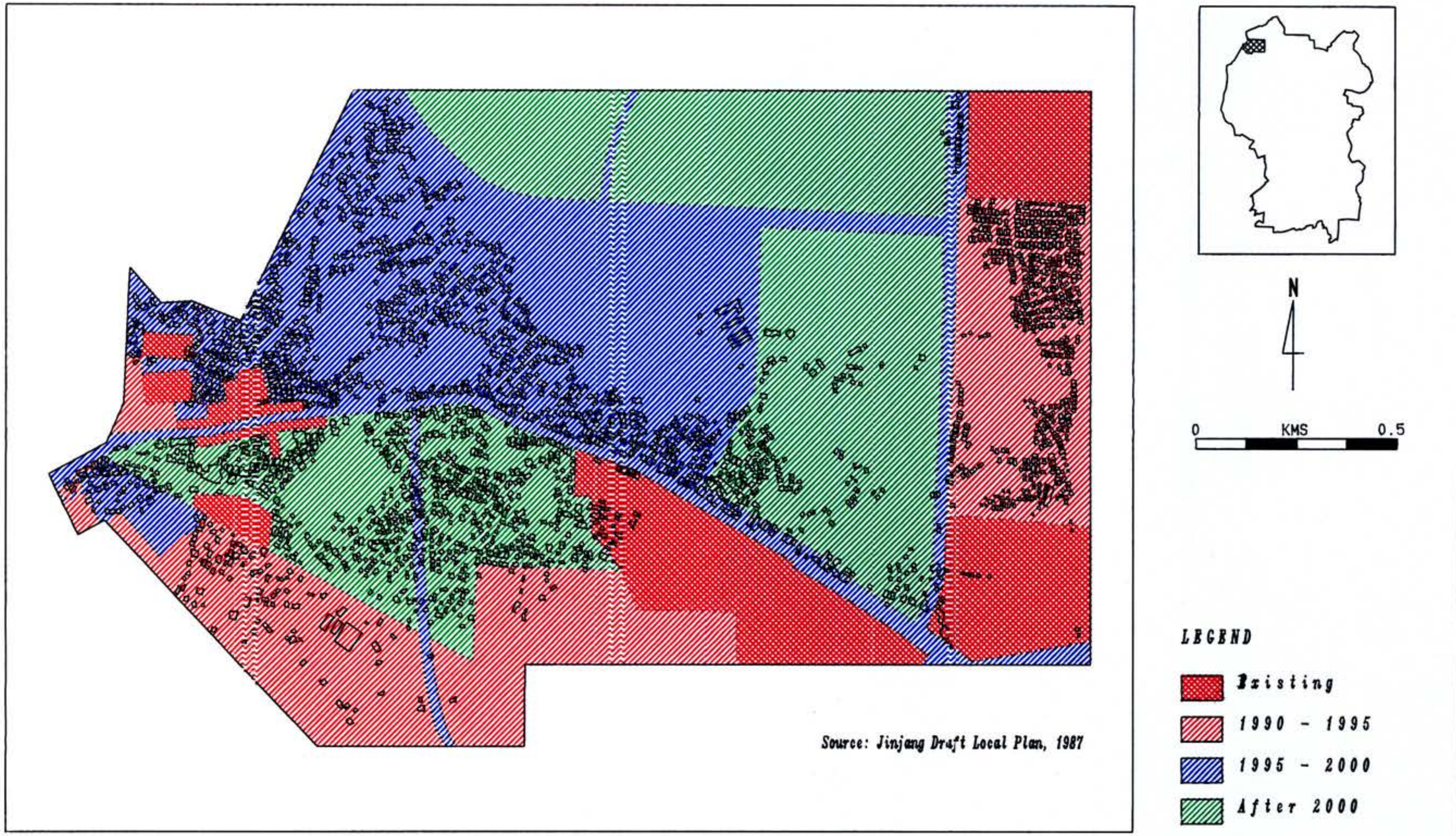
7.3.4 Development Phases

As noted earlier, the phasing of the developments is based on 3 categories i.e. approved developments, development applications which are under consideration and other proposed developments until the year 2000. The phases are divided into 4 stages, in accordance with the local plan time frame (Figure 7.5). The developers involved in the various development proposals will have to devise the programmes for the squatters affected by the projects according to the relevant stages. Examination of the

Figure 7.5

JINJANG/KEPONG SQUATTER SETTLEMENT

PHASES OF DEVELOPMENT



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data reveals the different numbers of people affected in each phase (Table 7.5).

Table 7.5: Types of Affected Existing Squatter Buildings by Phases of Development

Existing building / Development Phase	Housing No	Housing %	Industry No	Industry %	Commercial No	Commercial %	Public No	Public %	Total No	Total %
Existing	48	2.1	8	3.7	8	10.5	0	0.0	64	2.5
1990-1995	649	29.1	20	9.2	0	0.0	5	45.5	674	26.6
1995-2000	832	37.3	127	58.5	45	59.2	2	18.2	1006	39.6
After 2000	705	31.6	62	28.6	23	30.3	4	36.4	794	31.3
Total	2234	100	217	100	76	100	11	100	2538	100

Source: Jinjang/Kepong Squatter GIS, 1990

Existing development (Phase I) involves 64 buildings. These require immediate attention from the authority (Table 7.5). Phase II (1990 - 1995) includes the area already approved for development by the private developers. There are 674 squatter buildings in the area and the developers will have to devise programmes for these squatters within a 5 year period. Phase III (1995 - 2000) will involve both the City Hall and the privatised projects. It is important to prepare a detailed programme for the squatters since it will affect a major proportion of the buildings i.e. 1006 buildings or 40% of the total. The area which is zoned for both future housing and government use is categorised as Phase IV (after 2000). This phase will affect 794 buildings (31%). At the moment there is no layout plan for the area nor a plan of action for the affected squatters.

It is quite clear that the estimated phasing of development is not well coordinated with the housing requirements of the squatters. For instance, the proposed industrial development (Phase III) will take place before the housing development (Phase IV). As stated earlier, the proposed industries involve a large number of squatter households. However, there are no specific housing developments in any nearby areas which can accommodate these people. The only probable solution would be to relocate the squatters in other housing areas outside the Jinjang/Kepong settlement. Consequently, this will increase the distance to work place and travel cost.

Table 7.6: Socio-economic Characteristics of Affected Squatters by Phases of Development

Scenarios / Phase	Family		Population		Income less than $600		Walking Dist.more than 2 ml.		Dwelling Unit	
	No	%	No	%	No	% *	No	% *	No	%
Phase 1	56	2.2	319	2.3	35	72.9	24	50.0	48	2.1
Phase 2	722	28.2	4105	29.5	473	72.9	322	49.6	649	29.1
Phase 3	1007	39.3	5255	38.8	588	70.6	411	49.4	832	37.2
Phase 4	778	30.6	4259	30.6	425	60.3	382	54.2	70	31.6
Total	2563	100	13906	100	1521	68.1	1139	100	2234	100

Note: * % of households affected by the respective phase
Source: Jinjang/Kepong Squatter GIS, 1990.

Table 7.6 was designed to gain a better understanding of the socio-economic characteristics of squatters affected by the different development phases. A major feature of Table 7.6 is that almost 70% of the squatter households who are affected at one time or another by the proposed developments have income less than $600 per month. These people can only afford to buy houses which cost about $10,000 per unit (Table 7.8). This would mean that a sufficient number of houses at that price would have to be provided in all the phases, to meet the demand of squatter families who have to be resettled. Consideration should also be given to the location of the houses, since about 50% of the squatters work within a 2 mile radius of their homes.

7.4 An Overview of Squatter Resettlement Programmes

The above discussion has clearly shown that local plan proposals for Jinjang/Kepong will involve squatter relocation as well as the replanning of the existing squatters areas for housing programmes in line with the City Hall planning regulations. Detailed programmes and policy guidelines for the affected squatters should be scrutinised to avoid the failures of past housing policies. Previously, the main solution for squatter resettlement was the provision of low-cost flats. It is therefore important to evaluate how well this approach worked, to determine the extend to which it needs to be modified, in the light of present and future requirements for rehousing.

7.4.1 Types of Low-cost Housing in the Past

Due to pressing demand for land in Kuala Lumpur, the authority set the preference for high rise buildings (popularly known as flats) for its low-cost housing projects for squatters resettlement. The kind of flats that were constructed for the low income group were normally four storeys or more. Each dwelling unit in these flats consisted of either one or two bedrooms. The floor area of a one bedroom flat was 386 sq.ft. while a two bedroom unit was 530 sq.ft. (Malaysian Government, 1968). In 1970 the cost of buying such a unit ranged from $5000 to $8000 (Amato, 1972).

The low-cost housing unit provided by the government through its housing projects was found to be not the kind of house desired by the majority of the squatters, because the number of rooms in each unit was too small to accommodate the average family size. For the Jinjang/Kepong squatter settlement, it has been calculated that 71.5% of the families have more than 5 people. The average size of their present houses is more than twice (1171 sq.ft.) the size of the low-cost unit. Nearly 70% of squatter houses have two or more rooms. The majority preference for houses with at least three rooms has been clearly indicated in the previous chapter.

The low-cost housing unit provided by the government is therefore considered not to meet the housing needs of squatter families, particularly with respect to the nature and size of the average squatter family in the Jinjang/Kepong area.

7.4.2 Financial Aspects of New Dwelling Units

Another crucial question is about low-cost housing itself - namely, whether the low-cost housing is really low cost? At current prices, the cost of the cheapest form of housing in Kuala Lumpur is about $12,000 (Table 7.7). The rent for a low-cost flat is between $50 - $100 per

Table 7.7: Estimated Housing Cost 1987

Type	Cost ($ '000)	Rent per Month ($)
Detached	120 - 700	500 - 1000
Semi-detached		
Single Storey	60 - 80	350 - 450
Double Storey	70 - 120	400 - 600
Row Terrace		
Single Storey	35 - 60	200 - 350
Double Storey	50 - 100	300 - 400
Low-Cost Flat	15 - 25	50 - 100
Cluster Link	12 - 15	40 - 60
Site and Services (Project by Urban Development Authority)	3	-
Squatter house	1 - 5	20 - 40

Source : Compiled from Annual Property Market Report 1985 and Kuala Lumpur City Hall data, 1987

month. For low income families, housing expenditure would take 15-20% of their monthly pay. This would mean that a family with $200 can only contribute $30 towards housing costs (Table 7.8). However, the study has indicated that most squatters who have to be resettled (in accordance with the local plan development proposals) earn less than $600 per month. Obviously, these households could not afford to buy the least expensive publicly constructed houses even if they were available. However, they could afford to rent either a low-cost flat or cluster link house (Table 7.7).

Table 7.8: Types of Housing Expenditure by Distribution of Monthly Household Income.

Monthly Household Income ($)	Percentage of Income for Housing	Monthly Housing Expenditure up to $	Value of House Loan (20 yrs @ 10% int.)	Percentage of Households in Jinjang/Kepong (%)
Less than 200	15	30	3,000	5.2
200-399	17	68	6,000	20.3
400-599	20	120	10,000	42.9
600-799	25	200	15,000	16.5
800-999	27	270	20,000	9.8
1000 +	30+	300 +	30,000 +	5.3

Source: Data calculated from (1) Review of the Housing Situation in the Federal Territory 1980; (2) UDA Survey on Squatters in the Federal Territory 1976; (3) Jinjang/Kepong Squatter Database, 1990.

The relationship between squatter income and the possible value of a housing loan, reveals the bare fact, that over 70% of the squatter households could not afford to buy the least expensive low-cost flat or a cluster link house. As indicated in Table 7.8, squatters who earn less than $600 (70% of squatter households) can only afford to buy houses with a value of $10,000 or less. Yet the least expensive low-cost flat or cluster link is $12,000, but more typically they are in the range of $15,000 to

$25,000. It is clear that the low-cost housing price is beyond the squatters reach. It is therefore incorrect to give the label "low-cost" to this kind of housing.

The low-cost houses provided by the government in the past also incurred extra expenditure in term of providing social amenities which were absent in the squatter settlement. Inevitably the additional costs of the housing schemes were generally passed on to the house-buyer at the receiving end. This supports the view by Turner (1976, p.82), that,

> '...the bureaucratic heteronomous system produces things of a high standard, at great cost, and of dubious value, while the autonomous system produces things of extremely varied standard, but at low cost, and of high use-value'.

Clearly, a low-cost housing scheme for a squatter settlement will require substantial public subsidy if it is to be successful. Such a subsidy should contribute to reduction of overall housing costs so that suitable houses come within the reach of those who need them.

7.4.3 Cultural Impact of New Dwelling Unit

Past experience has shown that most people who were resettled in low-cost high rise flats faced difficulties in adapting to the new environment. The small proportion of Jinjang/Kepong squatter households (3%) who do not mind moving to high rise flats is indicative of the unpopularity of such housing. The high rise flat is considered as something "western" and quite alien to most people in Malaysia (Ibrahim, 1977).

Even though the squatters in Jinjang/Kepong have more than 15 years experience of urban life, they are still tightly bound by village tradition. Their upbringing in the rural way of life affords very little similarity to the high rise flat. All their life they have resided in conditions similar to those in the squatter areas i.e. one storey timber houses and there is strong objection to being put in a "cage" some 12-13 storeys in the sky (Ibrahim, 1977). The availability of land as the chief reason for squatting also points to this background. Space is needed to rear poultry or grow vegetables and clearly neither of these activities are feasible in a "high rise environment". In the words of Diamond (Diamond et al., 1980) these flat-dwellers actually live in a "false" urban environment or as "pseudo-urbanites". Their outlook is more inclined towards the rural setting both in terms of education and standard of living.

Cultural factors also play an important part in choosing a house. Events like marriages and deaths need extra external and ground space which is quite impossible to find in low-cost flats.

Perhaps the most ardent and intolerable reason for disliking the low-cost flats is that it forces the break up of the extended family system. The extended family system has been a major aspect of Eastern culture and any attempt to dislocate such ties would be strongly resisted. The system has been a symbol of pride and security and, particularly to the Chinese, of prosperity. The Chinese incidentally form 95% of the Jinjang/Kepong squatter population. The extended family also forges closer family ties. In such a system respect for the elders is profound and it is this respect that the elders do not want to lose.

Most squatter households in the Jinjang/Kepong settlement typically have more than one wage earner. Having several families under one roof has become an economic advantage. Income and resources from family members are pooled together, thereby lightening any problem that might arise. Under one roof they usually eat from the same bowl and substantial amounts of money can be save by this means. This money can be reallocated to other expenses like education, leisure etc. Since rent is free it is obvious that moving into a flat would mean a substantial drain on finance.

It should also be noted that members of the extended family contribute in a major way to the labour and resources required in small scale home industries (DBKL, 1983). The break up of an extended family is not merely physical, as one may observe, but more is also lost both culturally and economically.

In the final analysis, the cultural factor would be one of the important factors that should be considered in devising plans of action for squatter resettlement.

7.4.4 The Social and Psychological Impact

Social considerations may be the most factors in explaining the reluctance of squatters to resettle. Social ties are being initiated, moulded, forged and made stronger through the years of residence. To pluck the squatters from their present sites to new locations would be uprooting the very ground on which they stand.

The bonds of friendship among squatters are founded on a mutual perception of common interests and problems. The most common one is the constant threat of eviction from the land by the authority. Such shared perception often finds expression in some form of institutional arrangement through which the interests of the squatters are represented and channelled. In the Jinjang/Kepong settlement there is a strong organisation, namely the Malaysian Chinese Association, which readily provides the rallying point for the squatters to meet the authority eye to eye. Also it would not be a rare occasion to discover that the local leader is the political strong man of the community.

Another important social feature is that despite their poor educational background they seem to be quite advanced in their thinking. For example, in Malaysia, we are still talking about citizen participation in the planning process. Yet, for these squatters, this idea has already manifested itself in their day to day decision-making process (Diamond et al., 1983).

Squatters see themselves as a perceptual group having much in common, especially the illegal occupation of land. Most of them are more or less in the same economic group. Their fear and dislike of being evicted from their homes bind them together through perceived shared interest.

The feeling of security in their present residence undoubtedly contribute greatly to their oppposition to resettlement in low-cost housing schemes. To people in the older squatter settlements like the Jinjang/Kepong, social ties of more than 15 years and the degree of trust and harmony built during this time is something to be cherished. This is well reflected when they come to confiding their problems and seeking out help to resolve their financial difficulties. For example, in an interview by INTAN about whom they turn to in their financial problems, more than 60% responded that they turned to their friends and relatives in the squatter areas (Diamond et al., 1983). Similarly, it is not that they cannot borrow from friends elsewhere, but because of their nearness and similarity of living condition, the understanding is greater, thus saving a lot of explanation and embarrassment. The situation is similar for other types of non-financial problems.

Similarity of economic stratification leaves a very narrow gap between the richest and the poorest of the squatters. This enhances inter-relationships and increases group perception. They tend to solve their problems amongst themselves rather than seeking outside help. They view this aspect with pride as a cohesive territorial group.

In the process of resettlement the whole fabric of social ties may be dislocated or even lost. This may create a sudden imbalance in social relations. One does not know what one's new neighbours in the flat are going to be like. Unfriendly or individualistic neighbours may ruled out the evening "chit chat" across the fence. This may outwardly look immaterial, but it is an important characteristic of squatter intercourse and undeniably a means to solve problems, vent frustration or just relax after a hard day's work. Neighbour's role are also expressed in the form of mutual help. This may range from exchanging newspapers to borrowing tools, utensils and even ingredients. One may lose this in moving and it may take quite some time to adapt to a new environment such as that offered by the high rise flat.

Brought up in an environment with plenty of open space, any restriction would cause inconvenience especially to the young. Most flats built by the authority in the past have corridors that were meant for walking rather than as children's playgrounds. A check on several low-cost flats around the city found that play grounds for the children living in those flats were considered inadequate and some of them had none available at all. The children played along the corridors, in the lifts, behind parked cars, or even at the electricity transformer which is fenced and marked "danger". Also, the height has been much cited as a source of danger for the young and a nuisance for the old (Keat, 1974). Studies on high rise density also indicated that high density can cause emotional strain, particularly in the form of worry and unhappiness (Saidi, 1991).

In short, the authority, besides improving the low-cost flat, should also explore other alternatives for the squatters. The low-cost flat should be improved in terms of its design, price and location so as the meet the real requirements of the squatters.

7.5 Conclusions

The introduction of structure and local plans in the Malaysian planning system, represented a change from development control planning which favoured the rather static, land use based plan, towards a more strategic approach that incorporated social and economic factors as well as land use. As regards the squatter problem, the Kuala Lumpur Structure Plan emphasised the need to integrate the squatter community into the overall housing programme. Having recognised the failure of providing low-cost flats for squatter resettlement, the authority have now drawn policy guidelines which are hoped to be more effective. In this chapter, a better understanding of the possible implications of this policy has been gained by translating the authority's proposal into a physical plan and overlaying it with the existing squatter database. The resulting scenarios emphasised the need for more specific guidelines to assist in continuous monitoring of the housing development programmes. The authority should also explore other alternatives in terms of the method of housing provision, such as site and services or self-help housing programmes.

Owing to its dynamic nature, the squatter phenomenon necessitates constant monitoring of change, thereby creating a very real demand for flexible information systems. The characteristics of this mode of management, place major demands on the strategic information system required to support it and the technological and methodological devices needed to assist informed and effective decision-making.

CHAPTER 8

AN EVALUATION OF ALTERNATIVE SOLUTIONS

8.1 Introduction

There is no doubt that the squatter problem is a complex one, having social, cultural, psychological and economic implications. Attempts to solve it by any single and short term policy would only be a temporary measure and wrought with frustration. Further, it may give an illusion of "solving" the problem when in fact the situation is getting worse. As such, by only resettling or rehousing the squatter one could not hope to get to the root of the problem. It is apparent that more far reaching policies are necessary. The two levels of government, central and local, should develop a more explicit policy package reflecting certain principles and perspectives about the squatter problem. The central government should look at the national scale i.e. long term preventive measures while local government or in this case, the City Hall, should tackle the existing problem. In addition, the private developers should regularly be called upon to help the government through privatisation projects in the area occupied by squatters.

As of the squatter policies and programmes, the aim should be to integrate and establish harmonious relationships among the many different components of each settlement, so that action taken with respect to one element will not produce undesirable effects on the others (United Nations, 1974, p.71). It is at the local level that control measures such as zoning regulations, density and building regulations can be enforced, to provide the basis for harmonising the man-made elements with the natural environment.

This chapter examines the needs for a comprehensive squatter policy which include squatter resettlement, improvement, upgrading, as well as provision of low-cost housing and, site and services projects. A screening process will be used for the selection of suitable area for the various development strategies. In this process, spatial modelling techniques will be employed, based on the Jinjang/Kepong squatter GIS, to identify alternative development strategies for the area. Finally, this chapter evaluates development strategies in terms of their cost and benefit.

8.2 Review of Squatter Policies and Programmes

The local government, in this case, the City Hall should review their policies and programmes and should try to understand the problem of squatters, their role in society and lastly, perhaps most crucially, whether all the squatter settlements need to be cleared.

It is true that the squatter settlements in Kuala Lumpur are unplanned and sprawl haphazardly, but squatting in itself is a part of the normal urban growth process, though in an uncontrolled form. The presence of squatters in urban settlements therefore does not necessarily constitute a problem at all. Their uncontrolled growth, their proportion of the total population of Federal Territory and the supposed "hazard" they represent are often distorted and exaggerated beyond reality.

As we have seen, the conditions of squatters in the Jinjang/Kepong settlement are not unfavourable. In fact, most of them are better off than people in rural areas, either in terms of the physical structure of the house, income or access to various urban ways of life. It would perhaps be illogical, therefore, to separate the squatter from his/her employment opportunities and let him/her slide into debt and other difficulties. Relocation projects act more often as a barrier than as a vehicle for social change.

Location need not necessary be changed if one wants to improve the living standard of the squatters. A change in economic status is more important and fundamental. If an original squatter site is sufficiently large and easily accessible, and with an accompanying increase in economic status, derelict squatter huts will be replaced eventually by more decent dwellings. No sensible person would want to live in the condition in which the present area is, if he can afford better accommodation.

The previous chapter has shown that a high percentage (75%) of squatters want to remain on their present site and are content with their present mode of life. The question which arises is whether there is a necessity to clear them just because flats are to be built. It is also necessary to examine the cultural, social, psychological and economic impediments to resettlement.

8.3 Direct Control Measures at the Local Government Level

To control the development of new squatter settlements, the government should not rely entirely on policy measures at the local level. Strategic policies should also be employed at the national level to tackle the origins of the squatter problem. By strengthening rural and small town development, for example, migration in search of better living conditions in major towns could be significantly reduced. It is considered timely for certain ministries or public agencies to be decentralised and relocated to smaller towns. More importantly, industrial development as a source of employment, should be injected into the less developed regions to mitigate the urban imbalance and to reduce the flow of poor population to the major towns like Kuala Lumpur.

On the other hand, direct control measures in problem areas should be emphasised by the local authority. Such measures may include demolition and resettlement, or improvement and upgrading of certain areas. This would, of course, depend very much on the characteristics of the individual squatter area in question.

To that end, each squatter settlement needs to go through a "screening" process to determine its characteristics and consequently the policies appropriate for solving the squatter problem at this level. The information gathered at this stage should be used to answer the following questions;

1 On whose land is squatting taking place?
2 What are the value and characteristics of the land?
3 Is the land suitable for housing development?
4 Will land be needed for public use? If so, where and when?
5 Are squatters affected by environmental hazards?

The answers could then be used to evaluate the alternatives which best suit the squatters as well as the city. There are 4 alternative programmes which may be undertaken: (1) demolition and resettlement; (2) upgrading; (3) improvement; or (4) no action taken.

Figure 8.1 illustrates the recommended screening process for the study area. The process starts with the above questions, which are then applied to the alternatives that can be undertaken by the authority. For example, the first question is whether the flood risk is low. If no,

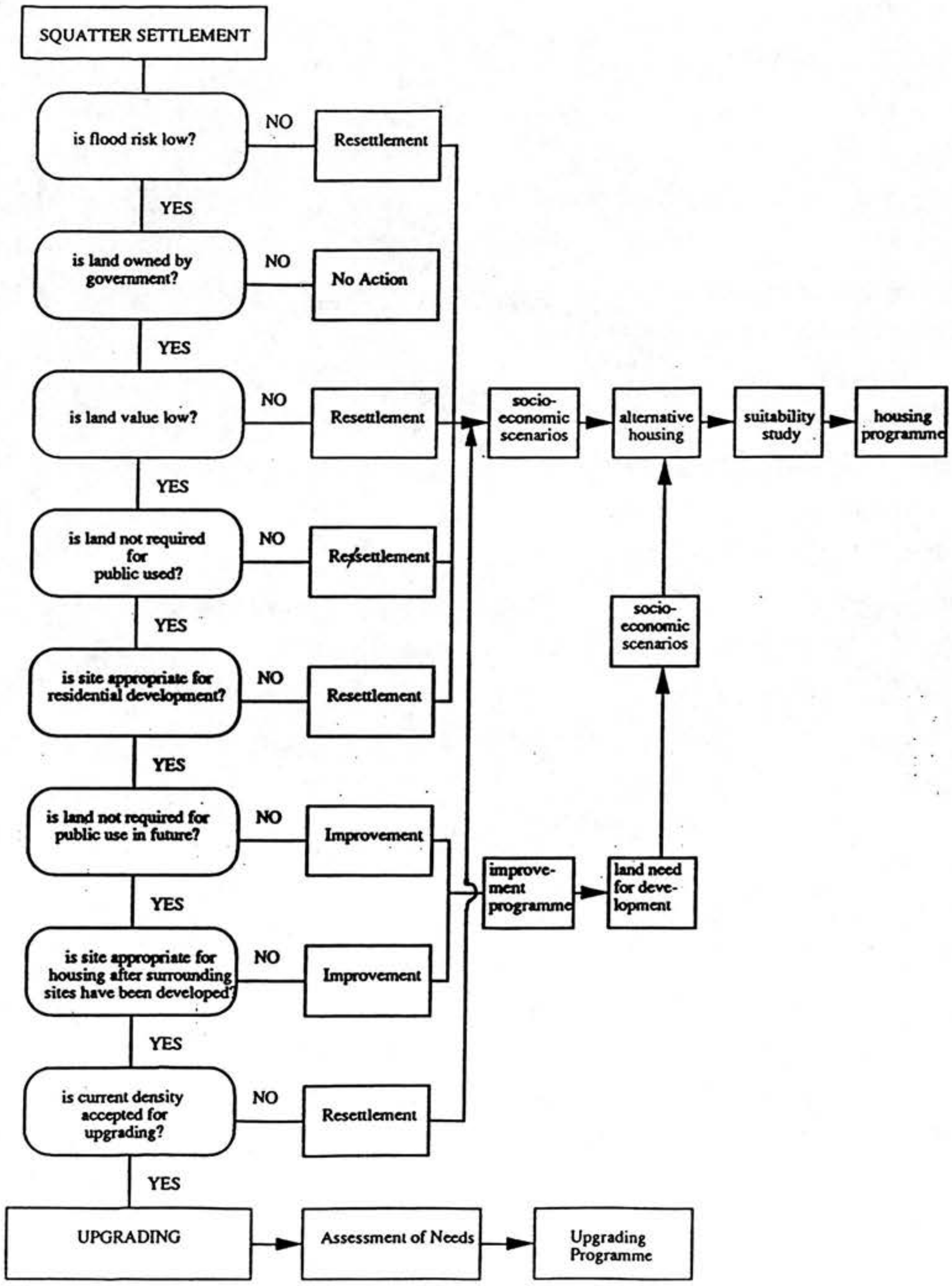


Figure 8.1 : Screening Procedure for Selecting Squatter Policies and Programmes

the obvious solution would be resettlement. If the answer is yes, other questions would follow, in this instance, whether the land is owned by the government. Each alternative solution would also be examined in relation to how it suited the squatters' requirements, as well as the characteristics of the area concerned.

8.4 Application of Spatial Modelling for Evaluation of Squatter Programmes

To simplify the screening process for evaluating squatter programmes, spatial modelling can be carried out for the area based on the available database.

For the study area, the methodology for evaluating the squatter settlement proceeds by abstracting certain information from the various GIS data layers, namely land parcels, planning regulations, squatter buildings, land uses and drainage. The relevant information which is required for the exercise includes the land value, land ownership, land use zoning, development phase, existing use, density and flood affected area. This information is considered to be vital for determining the land parcel characteristics and the appropriate treatment which will be embarked upon subsequently.

Figure 8.2 shows the overall flow chart for the above operation which can be implemented using GIS methods. By using the UNION command in ARC/INFO, a new coverage can be

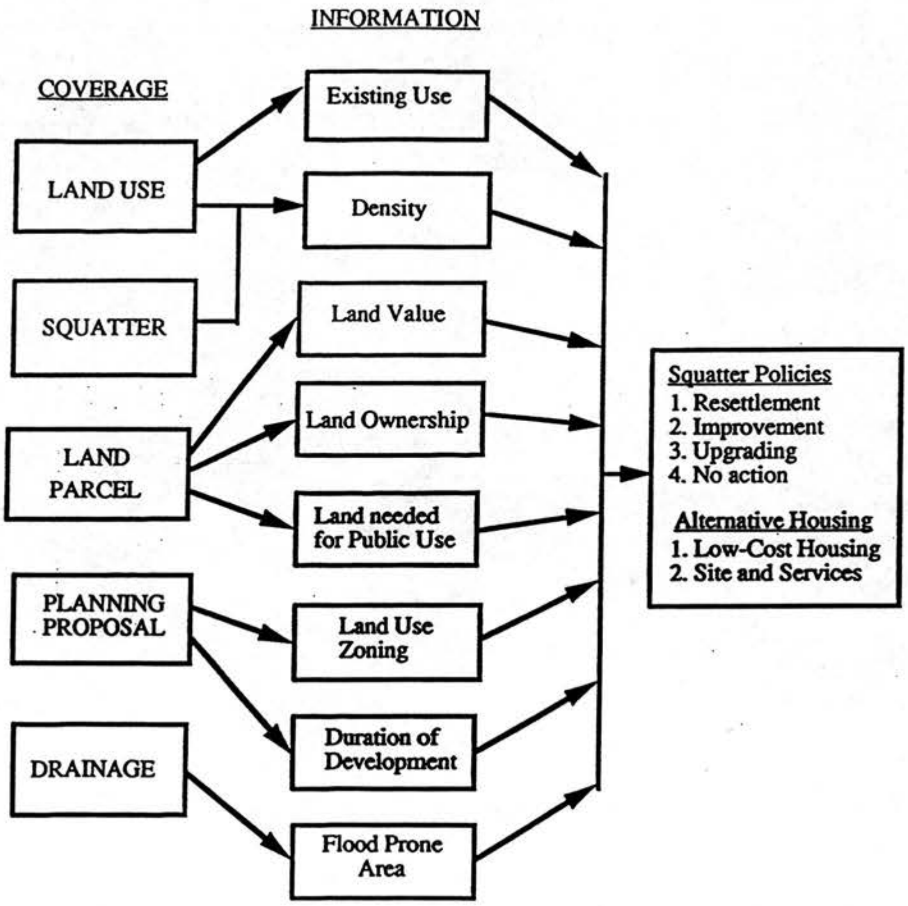


Figure 8.2 : Flowchart of Spatial Modelling to determine Specific Squatter Policies and Programmes

produced by combining two coverages. For example, the land parcel coverage can be combined with the planning coverage. The new coverage is then combined with the drainage coverage to produce another coverage (Figure 8.3). All the attribute data from the three coverages are accumulated in the final coverage. The RESELECT command is then used to abstract the relevant information for a specific task, in this case finding the suitable alternatives. There are of course many polygons in this coverage. The selected polygons are DISSOLVEd to get the area to which the individual alternative applies. Each area is then INTERSECTed with the squatter buildings and land use database to enable further study of the physical or socio-economic characteristics of the related squatters as well as the solution. By using ARC/INFO STATISTICS and the REPORT command in INFO, tabulated data is then generated for further analysis before alternative solutions are suggested.

Once the flow chart has been set up, the analysis proceeds automatically and equally for all parts of the surveyed area. No mistakes are made because a conversion code for a particular area was misread or omitted, as can sometimes happen when analysis is performed manually. It takes no more than a few minutes to implement this kind of analysis and it is simple to repeat the whole operation using other criteria for selection. Detailed analysis and the output produced by the operation will be discussed further below.

Figure 8.3

JINJANG/KEPONG SQUATTER SETTLEMENT
POLYGON OVERLAY

Compiled by Ahris Yaakup on ARC/INFO, July 1990

8.4.1 Squatter Policies and Programmes

While resettlement programme and the provision of low-cost housing have been implemented in individual schemes, as noted in the previous chapter, they have not been accepted as the basis for a comprehensive housing policy which addresses itself to the wider issues of housing provision, the eradication of poverty and the redistribution of employment opportunities. A United Nations report (Wehring, 1976; Jonstone, 1983), recommended that squatter upgrading and sites and services be incorporated into an integrated policy package based on an evaluation of the conditions in, and needs of, individual settlements. In looking at the different programmes, their suitability and how they are derived will be examined. The above screening process will be applied to the Jinjang/Kepong squatter GIS to identify areas suitable for the different strategies. By changing the selection criteria used in the screening process, various alternative proposals can be generated. Before the alternative proposals are evaluated, each of the strategies is first examined.

(i) Demolition and Resettlement

In line with the development plan proposal, the provision of new housing elsewhere to squatter households would enable the gradual development of the squatter area for housing. By building flats, the housing density can be increased and provision of facilities can be easily undertaken. While some of the area will be used for housing, other parts of the settlement will be developed for other uses. This would mean that most of the squatter buildings will be demolished to make room for the proposed development.

However, the study has shown that there is some area (Figure 8.7) which has some potential and can indeed be integrated into the existing urban development. By applying a screening operation, it can be shown that certain buildings can be maintained or improved while some have to be demolished and the households resettled.

For the purpose of demolition and resettlement, the Jinjang/Kepong squatter area will be subjected to five criteria. These criteria will be applied to all squatter buildings which occupy government owned land:

1 Areas which are needed for public purposes. These include reserves for road construction, flood retention ponds, river channelisation and public recreational areas;

2 Areas subjected to severe flooding. These will also include squatters who occupy privately owned land, since it becomes the government's responsibility to resettle squatters affected by flood. This is stipulated in the Kuala Lumpur Federal Capital (Clearance of Squatters) By-Law, 1963;

3 Areas which have a high value. Those locations with a value of more than \$3.00 per square foot are considered too expensive for upgrading projects to be economically feasible. Taking an average of 600 square feet for one housing lot, one household has to pay more than \$1,800 for the cost of the land. This is considered above the affordability level of those earning less than \$400 per month;

4 Certain areas are considered inappropriate for residential use, based on planning criteria such as existing zoning, adjacent land use and proposed types of development;

5 Areas which are immediately needed for development. These include areas scheduled for development within 5 years.

To get the squatter area most suitable for resettlement programmes, the RESELECT command can be employed to specify logical selection criteria which is then applied to the attributes of the combined coverage (Figure 8.3). Only those features whose attributes meet the selection criteria are kept.

As an example, the logical statement for the above purpose reads:

```
IF    land is government owned;
 AND  land is needed for public use;
 OR   land value is more than $3.00 per square
        foot;
 AND  land needed for immediate development;
 AND  land is not suitable for housing
        development;
 OR   land is privately owned AND subject to
        flooding;
THEN  land is suitable for resettlement.
```

The above expression is then translated into the ARC/INFO RESELECT command as follows (refer to Appendix F(a) for item definitions and Appendix F(b) for item values):

```
RESELECT OWN = 2 AND PRLU = 5 OR PRLU = 10 OR PRLU = 11
          OR PRLU = 13 AND PRLPD LE 2 OR VAL GE 3 OR
          FLOOD = 1

NSELECT

ASELECT OWN = 1 AND FLOOD = 1
```

Where,

```
OWN   = land ownership
PRLU  = proposed land use zoning
VAL   = land value
PRLPD = Phase of development
FLOOD = Area affected by flood
```

The candidate area will then be produced. The resulting coverage, which will be called the resettlement coverage, is shown in Figure 8.4. Figure 8.5 shows the resettlement area in relation to other programmes for the whole squatter settlement.

JINJANG/KEPONG SQUATTER SETTLEMENT
PROPOSED RESETTLEMENT

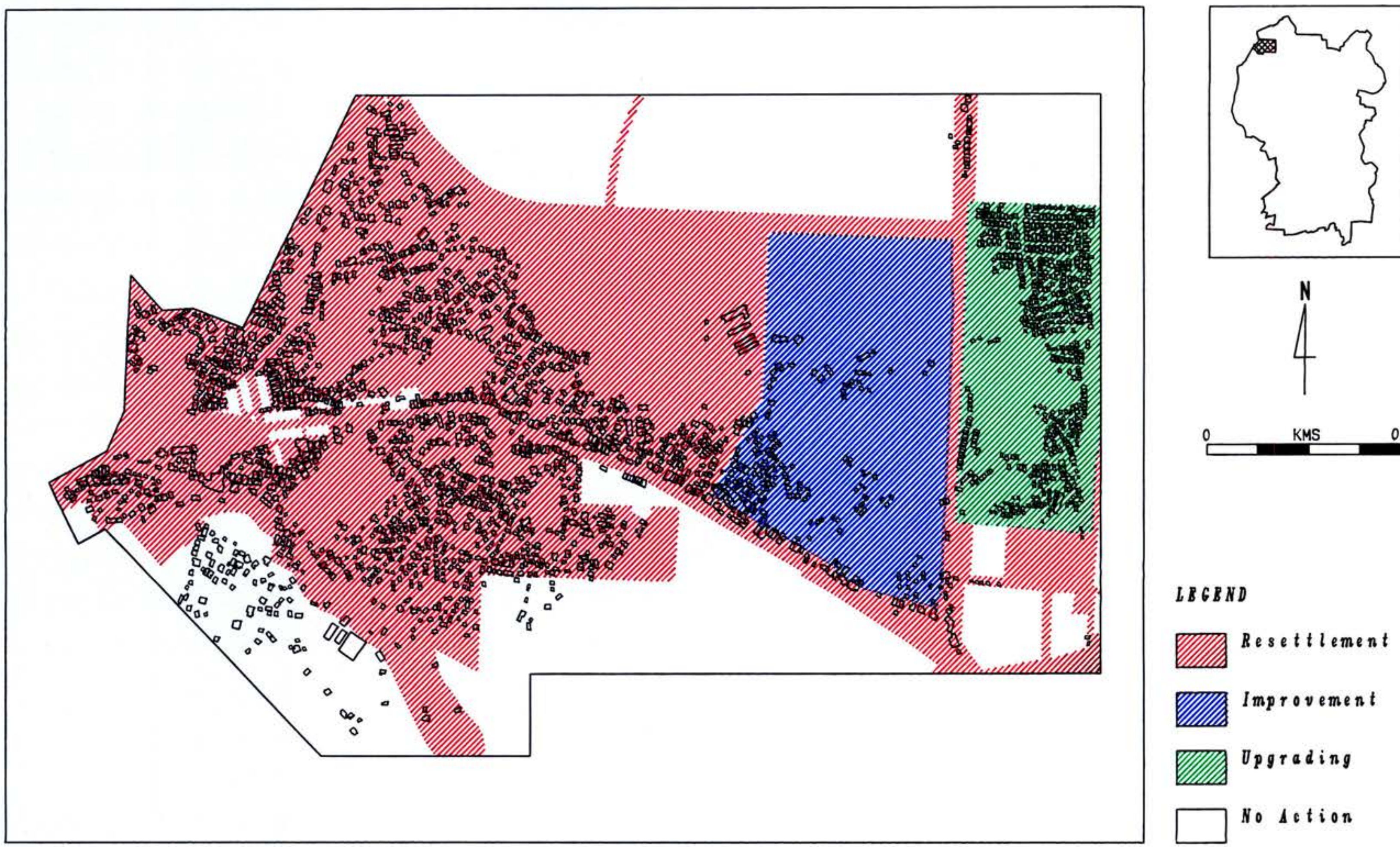
Figure 8.4

Compiled by Ahris Yaakup on ARC/INFO, July 1990

JINJANG/KEPONG SQUATTER SETTLEMENT

PROPOSED DEVELOPMENT STRATEGIES

Figure 8.5



Compiled by Ahris Yaakup on ARC/INFO, July 1990

The results of the above screening operation show that in aggregate a total of 1615 (67%) squatter buildings will have to be relocated. The same operation can also be used to calculate any area affected by any single criterion. As is apparent from Table 8.1 the main factor which necessitates the relocation of these buildings is the high land value. About 95% of the buildings affected by the programmes occupy land which cost more than $3.00 per square foot. As indicated earlier, high land values will make housing development economically infeasible. The same point applies even more forcibly to low-cost housing. Having identified the area for resettlement, it is also imperative that the future uses of this area are closely examined to ensure that these uses will be beneficial to the squatters who will be remaining in the vicinity.

Table 8.1: Types of Buildings Affected by Criteria for Resettlement

Affected buildings / Criteria	Housing No	Housing %	Industry No	Industry %	Commercial No	Commercial %	Public No	Public %	Total No	Total %
Flood	156	11.4	13	7.7	8	11.9	0	0.0	177	10.9
High land value	1309	95.3	162	96.4	63	94.0	6	85.7	1544	95.6
Needed for other purpose	351	25.5	54	30.1	1	1.5	1	14.3	407	25.2
Road improvement	189	13.7	50	30.8	20	29.8	0	0.0	159	9.8
Total	1374	85.1	168	10.4	67	4.1	7	0.4	1615	100

Source : Jinjang/Kepong Squatter GIS, 1990

Planning restrictions form the next most important controlling factor. About 25% of the squatter buildings are situated in areas that have already been zoned as industrial and commercial centres. About 10% of the buildings will have to be relocated as they are affected by road improvement schemes and other public developments. The area of flood risk is occupied by almost 11% of the buildings. Unless the area is improved in terms of drainage or other flood control measures, these people may have to be relocated. It should be pointed out that some areas may be affected by more than one criterion.

A majority of the buildings affected by the resettlement programmes are houses and they made up 85% (1374) of the total buildings. It should however be noted that most of the buildings involved are classified as "old".

Before the resettlement programmes can be initiated, a socio-economic analysis must be carried out to obtain information on the number of people involved, building use, type and location of employment, earnings and housing needs. This data is required to select a suitable area to be for resettlement of the squatters. It is also useful in evaluating whether the adjacent proposed housing development is enough to cater for the number of squatters to be resettled, in line with the local plan's proposal in terms of density zoning.

Table 8.2: Socio-economic Characteristics of Squatters to be Resettled

Characteristics / Income ($)	Family		No. of people		Work-place less than 2 miles		Preferred house ($15,000)		No. of house-holds	
	No	%	No	%	No	%	No	%	No	%
Less than 200	75	4.8	361	4.3	43	6.2	41	15.8	67	4.9
200.00-399.00	313	20.1	1745	20.6	171	24.7	176	68.0	279	20.3
400.00-599.00	626	40.3	3407	40.1	267	38.5	35	13.5	553	40.2
600.00-799.00	309	19.9	1668	19.6	132	19.0	5	1.9	260	18.9
800.00-999.00	137	8.8	769	9.0	37	5.3	2	0.8	125	9.1
1000.00/more	95	6.1	540	6.4	43	6.2	0	0.0	90	6.5
Total	1555	100	8490	100	693	100	259	100	1374	100

Source: Jinjang/Kepong Squatter GIS, 1990

This data can be simply obtained by using the INTERSECT command in ARC/INFO to overlay the resettlement coverage with the squatter database. The STATISTICS and REPORT commands in INFO can subsequently be used to perform cross tabulation of the resulting data.

Table 8.2 shows the overall socio-economic background of the squatters who will be involved in the resettlement programmes. A total of 8490 people who make up 1555 families will be affected. Out of the total families, 65% are those earning less than $600.00 per month. Based on the previous analysis of housing affordability, this group of people can only afford to purchase houses which cost less than $10,000 each. In terms of price, only 18% of the people who have to be resettled prefer to pay about $15,000 for a house. Although it would be a considerable burden on the low income earners to own a house which cost more than $15,000, apparently, most people realise that they have to pay more to get a decent house. A more crucial problem will be for those who earn less than $400.00 per month. They make up 25% of those who have to be resettled. This group of people can only afford to pay about $6,000 a unit. Against this background, the local authority may have two options in providing houses which would lessen the economic burden of these people. The first is to provide low-cost housing with a considerable amount of subsidisation. The second is to provide self-help housing and on site services. However, in terms of location, the local authority would have to realise the fact that a majority of the low income group work within two miles of their present homes. Therefore, if the real requirement of these people is to be met, the local authority will have to consider building low-cost houses within the squatter area or on a nearby site.

Table 8.3: House Preference of People to be Resettled: Types of Houses by Method of Development

House Preference / Method	Detached		Semi-Detached		Terrace		Cluster		Flat 1 (1-5)		Flat 2 (6-10)		Flat 3 (15+)		No Answer		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Ready made	34	44.2	81	58.3	554	68.1	63	70.8	129	80.1	11	36.0	11	50.0	10	23.8	893	65.0
Half ready	15	19.5	18	12.9	98	12.0	9	10.1	8	5.0	3	10.0	2	9.1	5	11.9	158	11.5
Site/services	28	36.4	40	28.8	156	19.2	17	19.1	21	13.0	15	50.0	9	40.9	27	64.3	313	22.8
No answer	0	0.0	0	0.0	6	0.7	0	0.0	3	1.9	1	3.4	0	0.0	0	0.0	10	6.7
Total	77	5.6	139	10.1	814	59.2	89	6.5	161	11.7	30	2.2	22	1.6	42	3.1	1374	100

Source: Jinjang/Kepong Squatter GIS, 1990

The survey of housing preferences in Table 8.3 gives the general conclusion that most people who have to be resettled prefer ready-made terrace houses which cost less than $15,000 a unit and are located near their present settlement. While a majority (65%) of the people prefer ready-made houses, 23% prefer to be given the site and only 11% prefer site and services.

It is apparent that the local authority will face a dilemma in solving the squatter problem. On one hand they have to consider the afordability level of the squatters, which is very low. On the other hand, the authority has to assess its ability to provide suitable houses in the present economic climate.

It should also be stressed that not all the squatters who have to be resettled are poor. Nearly 30% of them have earnings more than $600.00 a month. The people in the medium or higher income bracket are considered to be capable of purchasing a house at market price. A number of them are professionals (6%) who earn more than $1,000 a month. The local authority should encourage these people to move out of the squatter settlement and they should not be given priority in purchasing low-cost or self-help housing. Since most of them can afford cars, houses in other locations will be more accessible to them as compared to the lower-income group.

The preceding analysis and discussion have shown that several factors will have to be considered if the resettlement programmes is to be successful. The real needs of the people should be realised. Otherwise demolition of the Jinjang/Kepong squatter settlement could simply result in the establishment of a new squatter settlement in another area. Alternative housing should be developed before the families are required to move. The new houses should be as close as possible to the present settlement. In this way the people will be able to get to places of employment, schools and established friends.

For those who can afford better housing, their homes should be demolished and they should be encouraged to move into proper housing estates nearby. This move is considered proper, in that it would set an example to others not to take advantage of the situation. The local authority in this regard, should be firm and consistent with its demolition policy, if it is to make any progress in solving the squatter problem.

As regards industrial concerns, 168 are expected to be relocated into areas which have already been identified for them. The overlay of proposed land use and squatter buildings layers however, indicates that 54 industrial sites are already occupying the areas zoned for industry. If the siting of these industries is not too much in conflict with the proposed layout, it is recommended that the industries be maintained.

The area identified to be suitable for the scheme also includes 1.27 hectares of vegetable farms. The squatter farms, unlike industries, cannot afford to pay for land at urban prices. On the other hand, vegetable farms can be located outside the city area, unlike commercial establishments which need to be located in highly populated areas. As the population of Kuala Lumpur increases, the demand for land and hence land prices will inevitably increase. Eventually market gardens will have to be relocated further away from the city.

(ii) Improvement Schemes

Improvement is recommended for areas that may be needed for public purposes in future, but for which there are no specific proposals for the next five years. In effect these areas are in reserve for future public development. Improvement involves a minimum of infrastructure development such as water standpipes, minimal paving of main roads, fire protection and drainage measures, where there is a threat to health. Renewable land leases up to three years would be granted. Improvement by the community to minimise public investment should be encouraged. At the same time, the local authority should also take stringent steps to prevent the area from being occupied by new squatters.

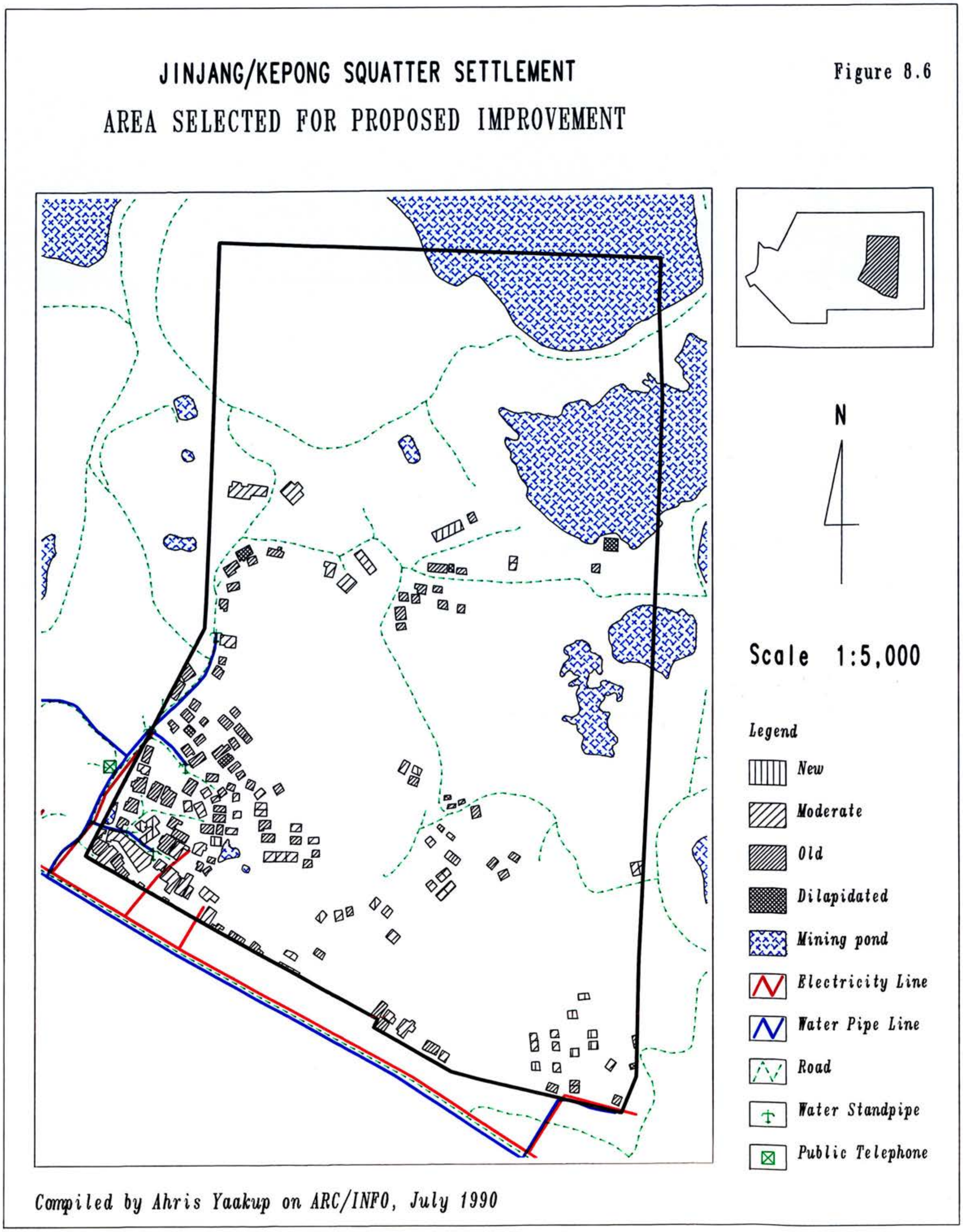
For the Jinjang/Kepong squatter settlement, the areas recommended for improvement schemes are identified according to the following criteria:

1 Government land which is reserved for institutional development in future but not before the next five years;
2 Areas which will not be appropriate for residential use when the surrounding areas are fully developed;
3 Areas where the land value is less than $3.00 per square foot.

The above criteria would mean that land which otherwise is left vacant, while waiting for construction to take place, would have a meaningful use with only minimal improvement cost.

The same screening method is repeated, in this case using the above criteria, to identify the areas suitable for improvement scheme from the GIS. The search criterion is given in Appendix F(c)(i).

Figure 8.6 shows the resulting area selected for improvement (see Figure 8.5 for the selected area in relation to the whole squatter settlement). It is then possible to analyse the physical and socio-economic characteristics of the area by overlaying it with the squatter building coverage using the CLIP command. Detailed information on the squatters who will be involved


JINJANG/KEPONG SQUATTER SETTLEMENT
Figure 8.6
AREA SELECTED FOR PROPOSED IMPROVEMENT
N
Scale 1:5,000
Legend
New
Moderate
Old
Dilapidated
Mining pond
Electricity Line
Water Pipe Line
Road
Water Standpipe
Public Telephone
Compiled by Ahris Yaakup on ARC/INFO, July 1990

in the scheme can be obtained by retrieving and manipulating the data for the selected area.

The area identified for the scheme involves 178 families who occupy 156 squatter houses. They comprise 854 people or 6.4% of the total population. A significant number of them are relatively new settlers. Of the total, 30% have stayed in the area for less than 10 years, as compared to the 14% who are involved in the resettlement programmes. About 80% of them give the reasons of house ownership and proximity to work place for staying there. In terms of housing condition, the houses can be generally described as moderate. The housing density is relatively low, as compared to the overall density, which is 15 houses per hectare. It is, however envisaged that the low density and the widespread distribution of houses will increase the cost of providing services to all households.

In terms of economic well-being, a large proportion of the people have earnings more than $600.00 per month (43%), while 13% have earnings more than $800.00 per month. They can all be grouped into the category of those who can afford to purchase a house at market prices.

In comparison, this area is not as hard pressed as the rest of the Jinjang/Kepong squatter area, in terms of economy, housing condition and density. As a temporary measure, the improvement scheme is considered to be suitable for this area. In the meantime, the higher income group should be encouraged to move out. Further, priority in purchasing low-cost houses should be given to those earning between $400.00 and $600.00 (36%) while those earning less than $400.00 (30%) should be aided in the acquisition of a plot of land for the site and services project.

For the 8 industrial buildings in this area, they should be relocated in areas zoned for industrial purposes. The gardening activities located in this area, however, should be given temporary leases. This will at least prevent the establishment of new squatter buildings.

(iii) Upgrading Schemes

For certain areas in the Jinjang/Kepong squatter settlement which can be integrated into the urban system, or where demolition is unnecessary, steps should be taken to improve or rehabilitate the squatter housing. An upgrading or rehabilitation programmes is considered to be the best measure for existing squatters, as such a measure does not remove the squatter dwellers from their job sources and their current social relationships. In order to facilitate the programme however, it is necessary to classify areas according to type, needs and the treatment most appropriate for each, as well as in conformity with the general outline adopted for development, as proposed by the Jinjang local plan.

Upgrading is recommended for areas that are appropriate for residential use and the land is not needed for a specific public purpose. Upgrading involves providing infrastructure improvements including paved roads and paths, piped water, sewerage, fire protection measures and drainage. Land will be subdivided and long term leases sold to the existing residents. Costs of the infrastructure improvements and land will determine the lease price. House improvement loans would be offered to residents for repairing and rehabilitating their homes. This programme could be undertaken without public subsidy except for administrative and planning costs.

The criteria used for identifying areas for upgrading are:

1 The land is owned by the government;

2 The area is not needed for a public purpose;

3 The area is appropriate for residential use according to the development plan;

4 Land costs are below $3.00 per square foot and upgrading is economically feasible;

5 The area is not subject to flooding;

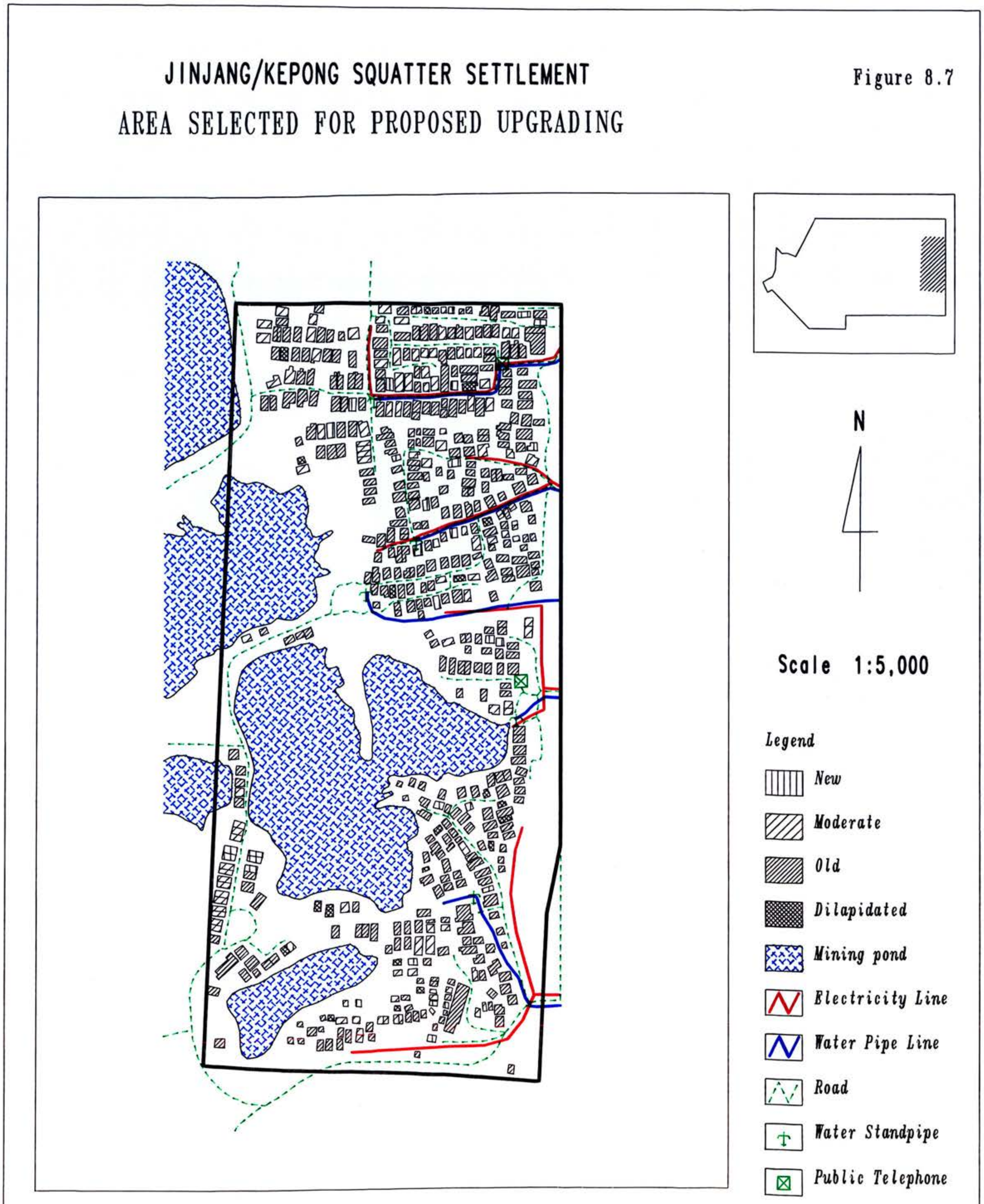
6 The existing density is more than 30 units per hectare, in line with the density zoning for the area, as recommended by the planning authority.

The areas suitable for upgrading can be determined by applying the above criteria to the study area using a similar operation to that for improvement or resettlement schemes. The logical expression is given in Appendix

F(c)(ii). The area suggested is shown in Figure 8.7 (see Figure 8.5 for the selected area in relation to the whole squatter settlement).

As indicated earlier, much work will have to be done on the area to be upgraded. It is first necessary to analyse the existing characteristics of the area. On the premise that the database for the study area is accurate, a clear picture can be presented. The necessary information includes the type and amount of existing infrastructure, the distribution of houses and the socio-economic background of the people involved. This will facilitate the provision of additional or improvement of existing infrastructure, and the distribution of loans for the purpose of relocating squatter industries or to upgrade the houses. Since the squatter GIS includes the housing condition, houses which need to be reconstructed can be easily identified.

The area to be upgraded will involve 3,330 people belonging to 584 families. They occupy 533 houses, most of which are free-standing (85%). Of the houses, 72% are in poor condition and in need of improvement. A majority of the squatters involved earn less than $400.00 per month and can only contribute 17% of their income towards housing expenditure. This would seem to justify the provision of loans to the needy squatters. A detailed upgrading exercise will be discussed in the next chapter.



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(iv) No Public Action

No public action is suggested when the squatter area is on private land. It is presumed that the use of this land is the responsibility of the land owner and not the local authority or government. The government however does have the power to resettle squatters from private land if there is a clear danger to public health or safety.

Land requiring no public action is identified based on the appropriate reselect expression given in the Appendix F(c)(iii). Figure 8.5 shows the result which indicates that 102 squatter buildings occupied the area. They are made up of 94 houses, 7 industries and 1 shop. Since the area is zoned for housing, the developer is expected to absorb these people into the overall housing scheme.

8.4.2 Alternative Housing Types for Squatters

At the present time the rate of private housing production appears to be unable to keep pace with even the middle and upper income markets. Thus there is a gradual tightening of the housing market. This lack of adequate housing production at the upper income level also restricts the supply for lower income families.

To improve the situation there must be a substantial increase in housing production for lower income families. As mentioned in Chapter 7, low-cost units form only 4.2%

of current houses in the Jinjang planning area and only 18.4% of the houses being built or to be built. It is clear that if the housing conditions for low income families in Jinjang area are to improve, housing production for low income group must increase substantially. The question to be asked is how can low-cost housing for squatters be increased? Two approaches are recommended, (1) self-help housing in areas where site and services are provided and (2) subsidised low-rise flat and terrace housing.

(i) Self-help housing in areas where site and services are provided

The site and services approach provides a means for low income families to build their own housing within a planned area where necessary urban services are provided. Unlike other forms of low income housing, site and services housing can be built with little or no public subsidies.

The necessary ingredients for a site and services programme in the Jinjang/Kepong area are:

1 An implementing agency (i.e. City Hall) to undertake the necessary planning, site development and financial management;

2 Land;

3 Modified design standards for roads, utilities and house construction.

City Hall 'should start planning its own slum and squatter areas, laying them out rationally and specifying exactly what purpose they intend them to fulfill' (Languin, 1968, p.202). In this exercise, the squatters are allowed to build their own houses, following minimum standards as to the type of construction, size and building setback to prevent haphazard growth. It is epecially suitable for resettlement of squatters whose present site are appropriate for residential use.

In this programme, the local authority acquires land, plans the layout for residential plots, roads and community spaces and installs such basic utilities as water, electricity, sewerage and drainage. It would also include social facilities such as schools, health clinics and services, such as refuse collection and fire protection. Any of the facilities or services may be excluded from the programme after consideration, either because they are being provided within the site under a separate programme or because they are being provided off-site in the vicinity of the project area.

Plots are allotted to squatter dwellers, who build their own house in accordance with their resources and requirements. The local authority may assist the residents in house building by providing them with building material and giving technical advice.

The Salak South site and service project is a pilot effort of the second Kuala Lumpur Urban Transport Project. It is demonstrating that a core house can be built without subsidy for families in the $300.00 per month range (Ujang, 1982). The project is receiving a positive response from most of the participants. Also, even lower income groups can be provided with housing, if more emphasis is given to self-help housing, in the form of providing the site, rather than providing a core house (Wehbring, 1976; Johnstone, 1983). More importantly, this sort of project can be carried out without unnecessarily causing "future shock" to the squatters, unlike the conventional low-cost high rise flat. The social needs as well as as cultural, psychological and economic needs are also catered for.

The criteria used to select site and services areas are as follows:

1 The land is government owned;
2 The area should be appropriate for residential use, not subject to flooding;
3 The area should be near the place of employment;
4 If the area is to be a permanent resettlement location, the area should be within at least two miles of the former settlement;
5 The land value in the area is below $1.00 per square foot;
6 The land is not needed for any public purpose;
7 The existing housing density is less than 10 units

per hectare.

The logical expression is given in Appendix F(c)(iv). Figure 8.8 shows the selected area. An area of 23.3 hectares has been identified. With a density of 145 units per hectare, such an area can accommodate 3379 families, sufficient to cater for the low-income squatter families. By comparing Figure 8.8 and Figure 8.5, it can be seen that the area selected for the proposed site and services programme is not identified for any other squatter programme.

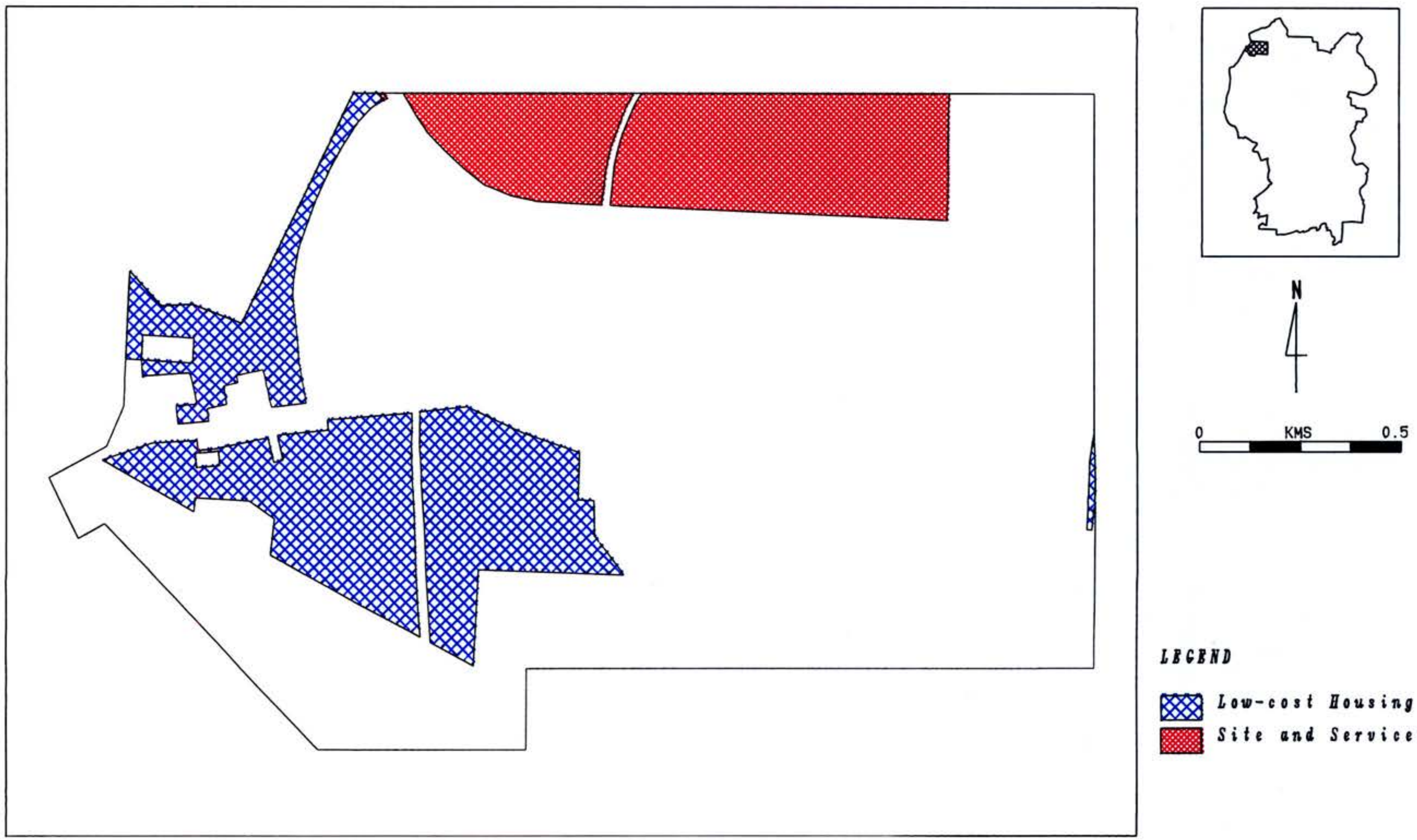
(ii) Low-Cost Housing (Flats and Terraced Housing)

Although self-help housing is recommended as a alternative means of housing production, low-cost flat and terraced housing programmes should be continued as a means of alleviating squatter problems, particularly for the low income group. The high rise flats (12 - 18 storeys) that have been developed in the past are not the preference of existing squatters. As shown in Chapter 6 (Table 6.9), 79% of the squatters preferred terraced houses, low rise flats and cluster link houses(1). The government has now adopted a policy to limit low cost housing to a maximum height of five storeys. A height of three storeys is preferable in term of livability and overall density.

However, certain improvements to the low-cost housing

JINJANG/KEPONG SQUATTER SETTLEMENT
PROPOSED HOUSING DEVELOPMENT

Figure 8.8



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currently provided by the government have to be undertaken. The price of the housing units should be reduced so that they can be within the economic capacity of the majority of squatters. This is possible through undertaking government control of prices of building materials, reducing the price of land or by reducing land speculation by means of zoning regulation.

An equally important factor in reducing the cost of housing is alteration of the current standards used in the industry, which in many ways do not allow optimum use of space. The prevailing standards for preparing layout plans for residential areas, industrial and commercial areas are more suitable for middle-class housing. While they ensure a satisfactory physical environment from the health point of view, they are not necessarily conducive to a healthy social and cultural setting for the lower income communities (Hai, 1976). These standards allow up to 50% of the land area being taken up by road reserves, open space and other public use. To demonstrate the idea that a more optimal use of land can be obtained, the Housing Developers Association in 1976 (DBKL, 1984), built 700 units of cluster link housing in the Cheras area. Each double storey house has a total floor area of 500 square feet, on a lot size of 546 square feet at a density of 58 units per acre. Housing costs are estimated at $7,500 per unit (including an assigned cost of $1.00 per square foot for land).

However, the study area will need to bear more than housing or land costs. Consideration will have to be given to resettlement costs, site clearance and reclamation costs for ex-mining land. In this instance, a relevant example is the slum clearance project in the Kampong Pandan area in 1985 (Ali, 1986). The project was to redevelop the squatter area as a low-cost housing estate and was undertaken by a private developer. Based on the privatisation concept, the developer had to pay all the development and construction costs of the scheme. For each low-cost unit, the selling price was to be not more than $25,000, even though the construction cost reached $35,000. The latter was the price of low-cost units as determined by the Ministry of Housing and agreed by the developer. Table 8.4 shows a detailed cost breakdown for the project.

Table 8.4: A detailed cost breakdown of the Redevelopment of Squatter area in Kampong Pandan Tengah, Kuala Lumpur.

Particulars	$ Per Unit
Land	1,000
Building	23,200
Infrastructure	8,000
Financing	1,000
Administrative and Sales	2,000
Total	35,200
Selling Price	25,000
Subsidy	10,200

Source: Ali, H.B.M (1986),' A Privatization Approach to Squatter Settlement Development', EMBA/ITM, Ohio University, p.27.

It is apparent that the project involved a considerable sum of money. To distribute the cost, cross-subsidy had to be employed. The "cross-subsidy units" were the units that generated income to enable the developer to build the low-cost units. They include the medium-cost units, high-cost units and shop-office buildings.

Based on the preceding locational and economic analysis, the sites for low-cost housing in Jinjang/Kepong area will be subjected to the following criteria:

1 The land is owned by the government;
2 The land is appropriate for residential use;
3 The land is not needed for any public purpose;
4 The land value is higher than the areas recommended for site and services.

The logical expression is given in Appendix F(c)(v). The selected area is shown in Figure 8.8. A total area of 66.4 hectares has identified. Assuming a density of 110 units per hectare, the area can support 7306 units. These can take in 38,000 people. To minimise cost, a mixed type of housing can be developed whereby only 58% of the area is developed for low-cost houses while the remaining area is to be built with medium and high cost units (DBKL, 1984). It can be seen that the whole area selected for low-cost housing (Figure 8.8) is also the area identified for the resettlement programme (Figure 8.5). Therefore, it is necessary to provide alternative housing for the affected squatters before formalised low-cost housing can take place.

8.5 Cost-Benefit Analysis of Alternative Squatter Strategies

8.5.1 Cost-Benefit Analysis

Having discussed the possible alternatives to solving the squatter problem, it is now appropriate that they be evaluated in terms of their cost and benefit both to the local authority and the squatters. The evaluation of the various scenarios produced by the screening operation will determine their relative economic efficiencies. This will facilitate the selection of the final solution. The cost benefit analysis will be carried out for one hectare of land to which each of the different development strategies is to be applied. This will then be used as multiplier in the database to calculate the cost-benefit of the various scenarios.

In this analysis, 3 types of squatter development will be considered i.e. (i) formalised low-cost housing; (ii) site and services projects; and (iii) upgrading of squatter settlement. All the assumptions used in the calculations are derived either from the Jinjang/Kepong squatter database or current secondary information. Owing to the difficulties of calculating social and other intangible costs and benefits, only private costs and benefits will be considered in this analysis.

Since the stream of benefits from the projects do not all occur during the same time period, an appropriate method for comparing the costs and benefits of alternative development strategies is the net present value method.

(i) Net Present Value Method (NPV)

The net present value method (NPV) is the method of valuing future income and cost streams. Basically the method allows one to compare benefits, costs, or both, that occur during different time periods (Schofield, 1987). The divergence between real and monetary values that arises because of the passage of time can be compensated for using this method by discounting all values to the present. The NPV equation reads,

$$NPV = \frac{P_t}{(1+k)}$$

where NPV is the net present value;

P is the monetary value in time period;
k is the required interest rate; and
t is the time period.

NPV is the real value today of money received in the future. Of course, this holds true for expenditure in the future. It is also obvious that the higher the interest rate, the lower the NPV is; equally obvious is that as t increases, NPV decreases. The above equation is for NPV of one monetary value occurring in one time period t. When several values occur during different time periods, the NPV equation becomes:

$$NPV = \sum_{t=0}^{n} \frac{P_t}{(1+k)^t}$$

that is the summation of the several present values. Once the monetary values, P, are known, the difficulty left in applying the method is to select the appropriate interest rate, k, to use in determining the present value.

(ii) Choice of Appropriate Interest Rate

A succinct review of the debate over the social discount rate and the appropriate interest rate for various types of public projects is provided by Mikesell (1977). Because of the complicating factors in determining the discount rate (k or i), it is not possible to specify the exact interest. However, most economists think that the discount rate will fall in the range of five to ten percent (Julian, 1980). For the analysis, a 7% interest rate is used (this was the average interest rate in Malaysia, 1989).

Since all the projects involve investment by the private sector, apart from the nominal discount rate (k), the relative inflation (f) is anticipated in the cash flow.

According to Brigham (1985), if inflation is reflected in both the cash flow estimate and in the required rate of return, the resulting expected NPV estimate will be free of inflation bias. It is particularly true in this case, as the streams of income and costs are accrued at different time periods during which real inflation has occurred. Hence, the NPV equation for those projects becomes:

$$NPV = \sum_{t=0}^{n} \frac{P_t(1+f)^t}{(1+k)^t}$$

The equation now reflects the fact that cash inflows (benefits) may be subject to a rate of inflation which may also be applied in the cash outflows (costs), but at a different time rate. Both may differ from the required rate of return or nominal (k) in the denominator.

8.5.2 Benefit-Cost Analysis of Formalised Low-Cost Housing

Low-cost housing commonly built by the public and private sector ranges from low rise (one or two storeys) to high rise (up to 18 storeys). The current public practice however seems to concentrate on medium rise flats (5 storeys) as the high rise type is not well received by the squatters.

In this discussion we assume that the developer will construct medium rise (5 storey) buildings as this type of flat will suit most of the squatter's requirements. It is also suitable for high valued land identified in the study area (Figure 8.8). This type of building is commonly called a walk-up flat and it has two or three rooms in each unit. The density allowed by the Ministry of Housing and Local Government for walk-up flats ranges from 75 to 148 units per hectare. The floor areas range from 300 square feet for a one bedroom flat to 600 square feet for a three bedroom flat which includes living room, bedrooms, kitchen/dining room and bathroom.

The developer is also required to reserve 30% - 40% of the area for road, open space and other infrastructure, like reticulations for telephones, electrical and water services, oxidation ponds and landscaping. The cost-benefit analysis of the proposed housing project that follows was undertaken by the author with the help of a quantity surveyor. A detailed breakdown of the development costs, revenue and computations is provided in Appendix G.

Assumptions:

1 There are 110 units of 5 storey flat per hectare (3 rooms per unit);

2 There are 580 square feet of floor area/unit;

3 The price is current in March 1989;

4 The houses are due to be completed within two years;

5 The average annual real inflation, f, of gross rent

for annual rental value is 6.5%, and for miscellaneous goods and services for maintenance is 4%;(2)

6 The monthly rental value of houses is $250.00 per unit or $330,000.00 per year for 110 units;

7 The life-span of the houses is 20 years i.e. similar to squatter housing and site and services housing;

8 The salvage value, Sv, in 20 years is $3,228,395.20, i.e., equal to the original investment cost;

9 The annual maintenance cost, Cm, is $161,419.76, i.e., 5% of the investment cost.

Cost-Benefit Analysis

i) Cost

Development Cost (Co)	$ per hectare
a) Land and Development Costs	353,847.88
b) Infrastructure Cost	432,914.14
c) Building Cost @ $20,000/unit	2,200,000.00
d) Administrative Cost	31,000,00
e) Professional Fees	210,633,13
Total Development Costs	3,228,395.00
Maintenance Cost (Cm) 5% of the development cost	161,449.76

The present value of the total costs for a twenty year period would be,

$$PV = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

At a 7% interest rate, k, and a 6.5% inflation rate, f, the total benefit is $7,119,832.40 (Refer to Appendix G for detailed computations).

ii) Benefits

	$ per hectare
Annual Rental Value (Bi)	
$250.00 @ 12 @ 110 units	330,000.00
Salvage Value (Sv)	3,228,395.00

The present value of the total benefits for a twenty year period would be,

$$PV = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

At a 7% interest rate, k, and a 6.5 % inflation rate, f, the total benefit is 7,119,832.00 (Refer to Appendix G for detailed computations).

The costs of the project comprise the development cost (Co) and annual maintenance cost (Cm). The maintenance cost is assumed to be 5% of the development cost, based on the Housing Developers' Association's estimation in 1989. Since the maintenance cost is incurred annually for a 20 years period, a 4% inflation rate, t, which is based on the average annual inflation of miscellaneous goods and services, is taken into account in the calculation of the present value of the maintenance cost.

One measure of the project's benefit is the annual rental value of the house. We assume that the monthly rent is

$250.00 per unit. A relative inflation rate, f, of 6.5% based on an average annual inflation of gross rent is used in computing the present value of the annual rental value.

The salvage value, Sv, is also a benefit of the project. Practically, the life-span of a well-maintained house could be more than 20 years. However, since we assume the life-span of squatter housing to be 20 years, the same period is also applied in this project. The value is assumed to be equal to the original investment cost because rising land value is estimated to offset declining value of the unit due to obsolescence.

Table 8.5: NPV of the costs and benefits of a formalised low-cost housing project

Cost	$4,821,455.50
Benefit	$7,119,832.40
Net (B - C)	$2,298,376.90
Ratio	1.48

The high cost of development is caused by the high land price and redevelopment cost of squatter areas which involve reclamation of poor quality land (largely ex-mining areas) and high administrative costs. As pointed out earlier, the developer has to sell the house at a price ($25,000/unit) well below the development cost ($35,000/unit). One way to offset the loss is by cross-subsidisation through the development of medium and high cost houses as part of the project.

The costs and benefits of the project discounted at a 7% interest rate for twenty years are presented in Table 8.5. The result shows that the benefits exceed the cost. At a 7% interest rate, the present net benefit is $2,298,367.90.

8.5.3 Benefit-Cost Analysis of a Site and Services Project

Site and services projects are another alternative to low-cost housing. They involve the provision of site and basic infrastructure, with the squatters being allowed to build their own houses. The assumptions used in the author's calculation of the cost and benefit analysis of this project are based on current evaluation of the pilot site and services project in Salak South, Kuala Lumpur (Appendix H). The recommended floor space was 8000 square feet on a plot area of 1200 square feet, which gave a gross density of 145 units per hectare. To further reduce the cost, provided infrastructure was sub-standard compared to other formalised housing. For the present study area, site and services is recommended for areas which have a value of less than $1.00 per square foot to enable the low-income earners to own a housing site. The cost of the project is minimised by providing very basic infrastructure. No professional fees are charged as most of the work is assumed to be carried out by the local authority.

Assumptions:

1 There are 145 units per hectare (three rooms, single storey);

2 The floor space is 800 square feet/unit;

3 The total area of dwelling is 1200 square feet/unit;

4 The price is current in March 1989;

5 The houses are due to be completed within two years;

6 The average annual real inflation, f, of gross rent for annual rental is 6.5%, and for miscellaneous goods and services for maintenance is 4%;(2)

7 The monthly rental value of the house is $150.00 per unit or $261,000.00 per year per 145 units;

8 The life-span of the house is 20 years, i.e. similar to squatter housing;

9 The salvage value, Sv, in 20 years is $1,387,442.45 i.e. equal to the original investment cost;

10 The annual maintenance cost, Cm, is $69,372,12 i.e. 5% of the investment cost.

Cost-Benefit Analysis

i) Costs

Development Costs (Co)	$ per hectare
a) Land and development cost	43,560.00
b) Infrastructure cost	256,382.45
c) Building cost @ $7500/unit	1,087,500.00
Total Development cost	1,387,442.45
Maintenance Cost (Cm)	
5% of the development cost	69,372.12

The present value of the total costs for a twenty year period would be,

$$PV = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

At a 7% interest rate, k, and a 4% inflation rate, f, the total cost is $2,072,079.70. (Refer to Appendix H for detailed costings and computations).

ii) Benefits

	$ per hectare
Annual Rental Value	
$150 @ 12 @ 145 units	261,000.00
Salvage Value (Sv)	1,387,442.43

The present value of the total benefits for a twenty year period would be,

$$PV = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

At a 7% interest rate, k, and a 6.5% inflation rate, f, the total benefit is $2,040,278.70.

The cost of the project is the initial development cost, Co, plus annual maintenance costs. The cost is slightly lower than a more formalised low-cost housing project due to the low land cost, sub-standard infrastructure at minimal cost and zero professional fees. The benefits are in the occupant's opportunity to rent a similar house elsewhere in the city. Although the rent can be accrued in perpetuity, we assume that the life span of each house is 20 years, equivalent to that for squatter housing.

The benefits and costs of the project are presented in Table 8.6. As in the case of formalised housing, the real inflation, f, is also taken into account in the calculation. (Refer to Appendix H for detailed computations).

Table 8.6: NPV of the cost and benefit of a Site and Services project at a 7% interest rate per hectare.

Present Value	per hectare
Cost	$2,072,079.70
Benefit	$5,135,311.30
Net (B-C)	$3,063,231.60
Ratio	2.49

It is obvious that site and services has a higher cost-benefit ratio than the previous type of project. This is due to minimal investment in infrastructure and the high return in the form of annual rentals.

8.5.4 Cost-Benefit Analysis of a Squatter Upgrading Project

Some squatter settlements can be integrated into the wider urban environment by upgrading the area into a decent housing settlement. This can be done by providing some order in the area and putting in the basic infrastructure. The information used in the following cost-benefit analysis is based on the area selected for upgrading as a result of the previous screening operation using the GIS.

For this project, the costs are obtained from a squatter home builder who works part-time on constructing houses. Since most of the houses in Jinjang/Kepong are built by the owner-occupier, we assume that the value to the owner is the rental value of equivalent property. A detailed breakdown of the costs, revenues, method of computation, and a description of the area is provided in Appendix I.

Assumptions:

1 There are 44 units of mixed type of houses;(3)

2 There are 1171 square feet of floor space per unit;

3 There are 2000 square feet of total area per house;

4 The monthly rental value is $120.00 per unit;

5 The life-span of each house is 20 years;

6 The price is current as of March 1989;

7 The average annual real inflation, f, of gross rent for annual rental value is 6.5%, and for miscellaneous goods and services for maintenance is 4%;(2)

8 The houses are made of wood/concrete;

9 A bare minimum of public facilities and infrastructure (paved road, pipe water, electricity and public phone) is provide by the authority;

10 The salvage value, Sv, is $485,120.00 i.e. equal to the original investment cost;

11 The annual maintenance cost, Cm, is $24,254.00 i.e. 5% of the investment cost.

Cost-Benefit Analysis

i) Cost

Development Costs	$ per hectare
1) Land premium @ $1.00 per square feet	87,120.00
2) Infrastructure cost	68,000.00
3) Building cost $7,500 per unit	330,000.00
Total Development Cost	485,120.00
Maintenance cost (Cm) 5% of development cost	24,254.00

The present value of the total costs for a twenty year period would be,

$$PV = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

at a 7% interest rate, k, and a 4% inflation rate, f, the total cost is $782,658.83 per hectare (refer to Appendix I for detailed calculations).

ii) Benefits

	$ per hectare
Annual Rental Value	
Year 1 = $31,680.00	31,680.00
Year 2 = $47,520.00	47,520.00
Year 3 through year 20 $63,360.00	79,200.00
Salvage value (Sv)	485,120.00

The present value of the total benefits for a twenty year period would be,

$$PV = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

At a 7% interest rate, k, and a 6.5% inflation rate, f, the total benefit is $1,574,858.76. (Refer to Appendix I for detailed costings and computations).

The cost of upgrading is slightly lower than for the low-cost housing and site and services projects. This is largely due to a very minimal infrastructural investment and the reduced number of buildings per hectare compared to the previous two projects.

The benefit of the project is the occupant's opportunity to rent an equivalent house at $120.00 per month. This is slightly lower than the rent assumed for a site and services unit i.e. $150.00, but more than the normal rent for a squatter house i.e. $100.00. The rental value for the first year is assumed at 50%, and for the second year 75%, of the monthly rental ($120.00). This value is based on the assumption that the house will not be fully completed during the first two years. The relatively high rent in both the upgrading and site and services projects is due to the improved condition of the house as well as the infrastructure.

The benefits and costs of the project are presented in Table 8.7.

Table 8.7: NPV of the Cost and Benefit of an Upgrading Project at a 7% interest rate

Present value	per hectare
Cost	$724,473.70
Benefit	$1,574,858.76
Net (B - C)	$850,385.06
Ratio (B/C)	2.17

The benefit of the project is twice the cost. The cashflow of upgrading project is lower than both the low-cost housing and site and services project.

8.5.5 Benefit-Cost Analysis of Construction by Squatters Themselves

With minimal facilities, simple design and material and lack of administrative and planning control, squatter houses are expected to be much cheaper than conventional or formalised low-cost housing and upgrading of squatter houses. An analysis of the costs and benefits of squatter housing is also undertaken to compare with the other housing alternatives. As in an upgrading project, the costs for this analysis have also been obtained from squatter home builders who work part-time on constructing houses. We assume that houses are built by owner-occupiers, and the value will be the rental value of equivalent property. A detailed breakdown of the costs, revenue and method of computation and description of the area are provided in Appendix J.

The assumptions used in the analysis are based on the existing database of the Jinjang/Kepong squatter settlement.

Assumptions:

1 There are 17 units per hectare;(4)

2 Each unit has 1171 square feet of floor space;

3 Each lot is 2000 square feet in area;

4 The monthly rental value is $100.00 per unit;

5 The life-span of each house is 20 years;

6 The price is current as of March 1989;

7 The Average annual real inflation, f, of gross rent for annual rental value is 6.5% and of miscellaneous goods and services for maintenance is 4%.(2)

8 The houses are made of wood and concrete;

9 A bare minimum of public amenities (unpaved road, 25 water stand pipes, electricity and 9 public phones for the whole area) are provide by government;

10 The salvage value, Sv, is $131,703.00, i.e. equal to the original investment cost. Although the houses may be demolished to make space for intensive urban uses, the owners will probably be compensated on humanitarian grounds. A higher salvage value is given because owners are likely to improve or invest in their houses as their income increases or longer tenancy is given;

11 The annual maintenance cost, Cm, is $6,585.50 i.e. 5% of the investment cost.

Cost-Benefit Analysis

1) Cost

Development Cost (Co)	$ per hectare
a) Land cost	-
b) Infrastructure cost	4,203.00
c) Building cost @ 7,500	127,500.00
Total Development Cost	131,703.00
Maintenance Cost (Cm) 5% of development cost	6,585.50

The present value of the total costs for a twenty year period would be,

$$PV = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

at a 7% interest rate, k, and a 4% inflation rate, f, the total cost is $197,707.78 per hectare (refer to Appendix I for detailed calculations).

ii) Benefits

Annual Rental Value (Bi)	**$ per hectare**
a) Year 1	**10,200.00**
b) Year 2	**15,300.00**
c) Year 3 to 20	**20,400.00**
Total Annual Rental Value	**459,000.00**
Salvage value (Sv)	**131,703.00**

The present value of the total benefits for a twenty year period would be,

$$PV = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

At a 7% interest rate, k, and a 6.5% inflation rate, f, the total benefit is $412,278.87.

The cost of the project is the initial development cost, Co, plus annual maintenance cost, Cm. The benefits are the occupant's opportunity cost of renting equivalent housing, Bi, and the salvage value. Although the rent can be in perpetuity, we can assume that the life of the house is about 20 years since it is of "inferior quality" (i.e. made of cheap material). After 20 years the house is presumed to be demolished but the owner will be compensated. The salvage value is assumed to be equal to the initial development cost.

Table 8.8: NPV of Cost and Benefit of an Existing Squatter Settlement project at a 7% interest rate

Present value	per hectare
Cost	$197,707.78
Benefit	$412,278.87
Net (B - C)	$214,571.09
Ratio (B/C)	2.09

Table 8.8 shows that the benefits of the project are greater than the costs of the project. At a 7% interest rate the net benefit is $ 214,571.09 which is comparatively lower than other types of housing development.

8.5.6 Benefit-Cost Comparison of the Squatter Development Alternative

As indicated earlier, the primary reason for the benefit-cost analysis is to provide the ratio to aid in comparing each development strategy which may be applied to the squatter settlement. Taking the ratio as a multiplier, it is then applied to the Jinjang/Kepong database to evaluate the possible planning scenarios.

Table 8.9: Benefit-Cost of Squatter Development Strategies

Development strategies	Cost ($)	Benefit ($)	NPV ($) (B-C)	Ratio (B/C)
Low-cost Housing	4,821,455.00	7,119,832.40	2,298,376.90	1.48
Site and Services	2,072,079.70	5,135,311.30	3,063,231.60	2.49
Squatter Upgrading	724,473.70	1,574,858.76	850,385.06	2.17
Existing Squatter	197,707.78	412,278.87	214,571.09	2.09

Source: Data calculated from the Jinjang/Kepong Squatter GIS, 1990 and cost-benefit analysis.

The summary results of the benefit-cost analysis shown in Table 8.9 indicate quite significantly that the existing settlement needs to be developed to optimise the use of land. At present it has the lowest benefit as compared to other forms of development. The most favourable form of development, especially for high value land, in terms of cash flow, would be the low-cost housing. It should, however, be noted that the benefit-cost ratio for low-cost housing development is the lowest as it requires substantial investment. A type of development which is favourable both in term of cash flow and cost-benefit ratio is site and services. This benefit can also be achieved by upgrading the settlement with minimum investment. However, to increase the carrying capacity of the site both the low-cost housing and site and services developments should be considered.

8.6 Evaluation of Alternative Planning Scenarios

Policy-makers, like most decision-makers, face the difficult task of evaluation and examining the impact of various resource allocations. In the past, the evaluation process appeared to be quite static and limited. Using GIS, it is now possible to evaluate the alternative planning scenarios more effectively by examining the spatial and socio-economic characteristics of different parts of the squatter area and the likely cost-benefit involved in the proposals.

Earlier in this chapter, spatial modelling techniques were employed to produce various alternative programmes for the study area. Using the cost-benefit ratio per hectare as an additional attribute, it is then possible to evaluate these programmes in term of their cost effectiveness. Using the computer, alternative programmes can be easily produced in a very short time. If the programmes is not accepted because of its cost-benefit implications or other spatial or socio-economic factors, alternative programmes can be produced by modifying the modelling procedure (e.g. by changing criteria through the RESELECT operation or by changing the data layer). Figure 8.9 illustrates the overall method of evaluation as described above.

For the Jinjang/Kepong squatter settlement, 4 alternative programmes have been developed and each will be examined below.

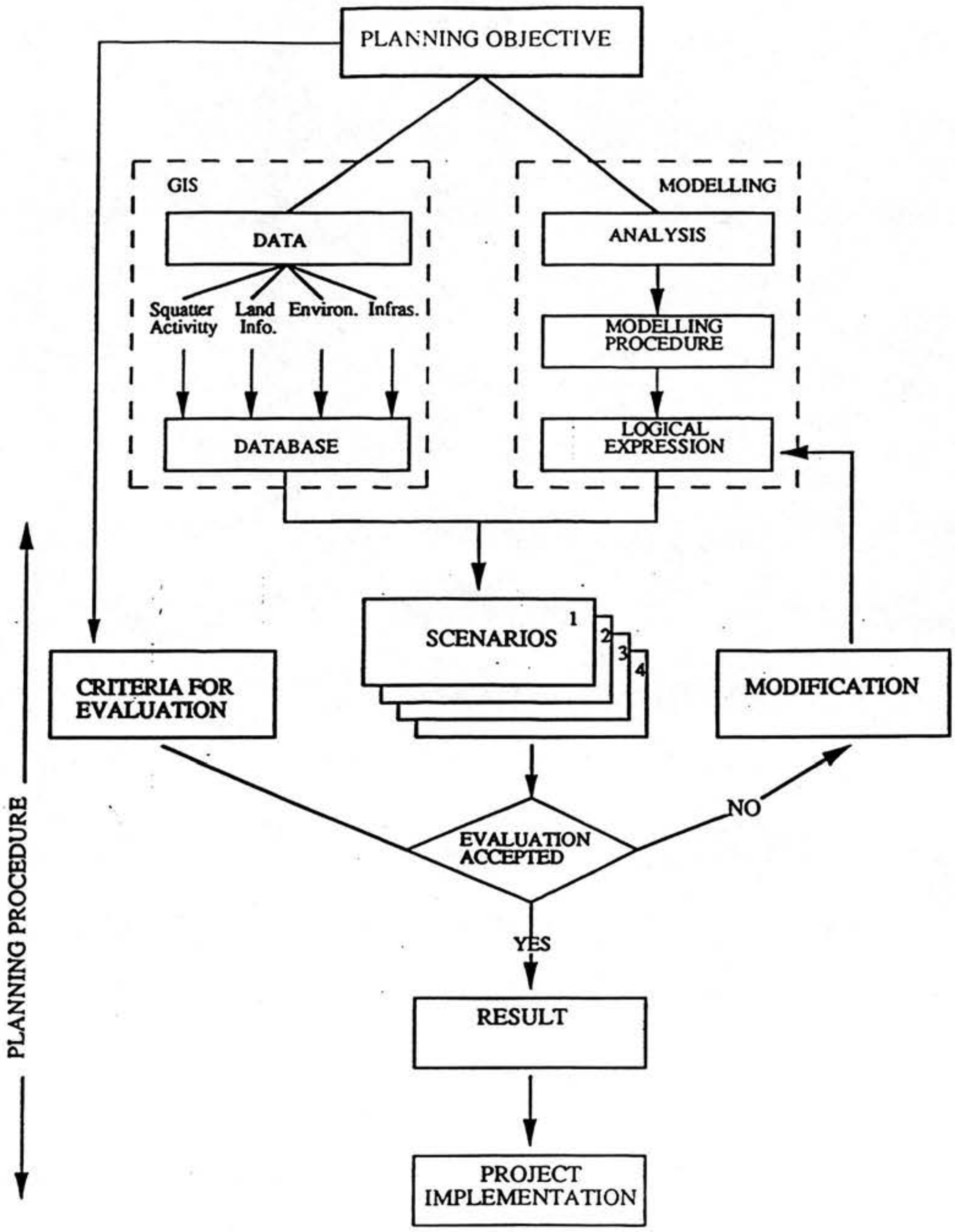


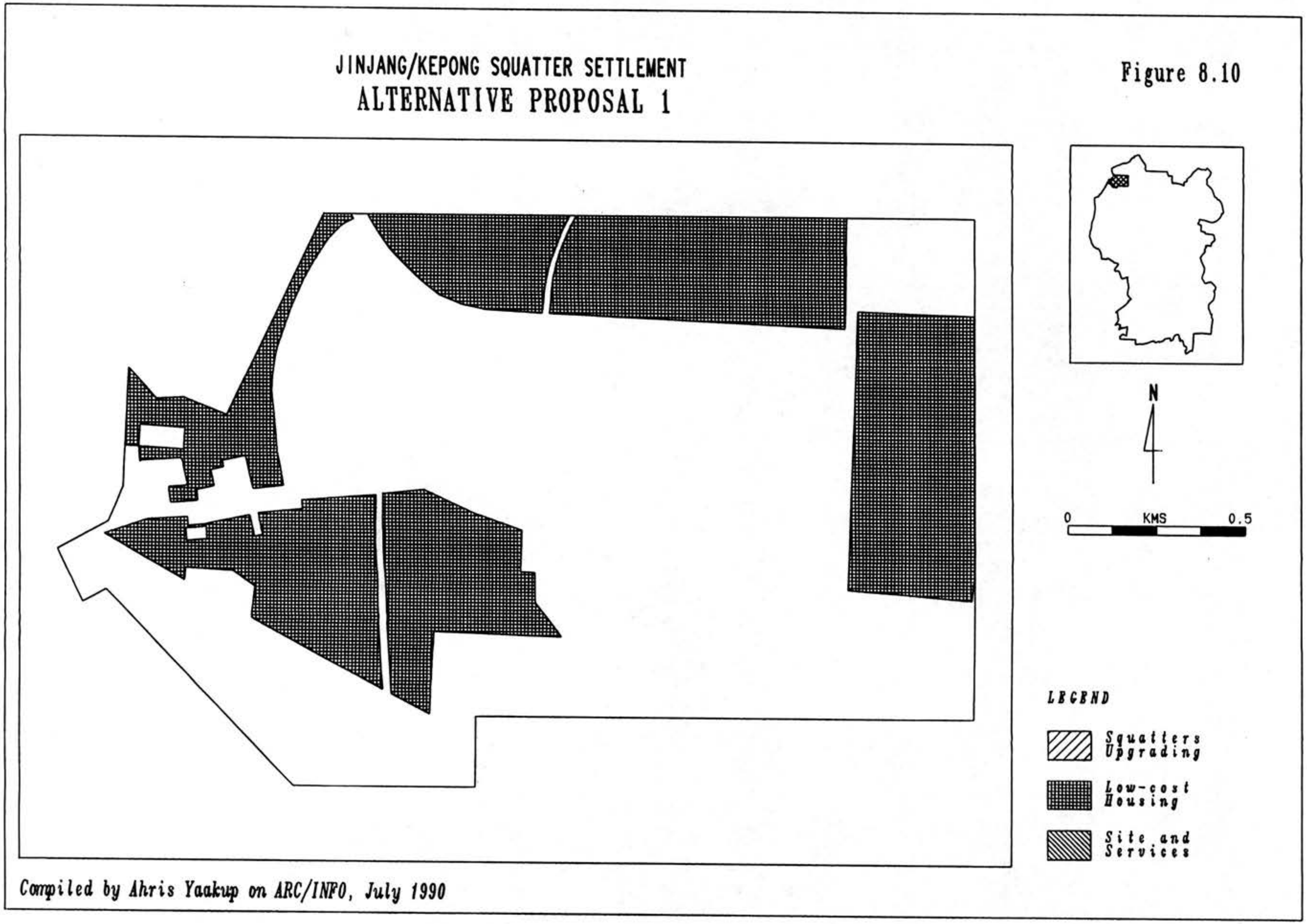
Figure 8.9 : Project Evaluation

8.6.1 Alternative 1

The first alternative is based on the strategy proposed by the Kuala Lumpur development plan. For the study area, the main principle of this strategy is to relocate all squatters, to enable the areas to be developed as housing estates or for other uses (Figure 8.10). This strategy has been discussed in Chapter 7. An area of 83.6 hectares of the Jinjang/Kepong settlement has been allocated for housing. If all the area is to be built with low-cost houses, it can accommodate 9257 houses with a density of 110 units per hectare. Taking an average household of 5.2 per unit, the area can cater for 48,000 people. However, according to the development plan, only 58% or 48.5 hectares of the area will be developed as low-cost housing. This would accommodate 5,300 houses, which is sufficient to cater for all the squatters as well as future requirements.

8.6.2 Alternative 2

This alternative, illustrated in Figure 8.11, is derived from the spatial modelling analysis carried out earlier in the chapter. This alternative will have mixed development, combining low-cost housing, site and services and upgrading schemes. Such an alternative is expected to reduce the burden among the low-income earners in obtaining low-cost housing. It will also lessen the number of people who have to be resettled. Based on the


JINJANG/KEPONG SQUATTER SETTLEMENT
ALTERNATIVE PROPOSAL 1
Figure 8.10
N
0
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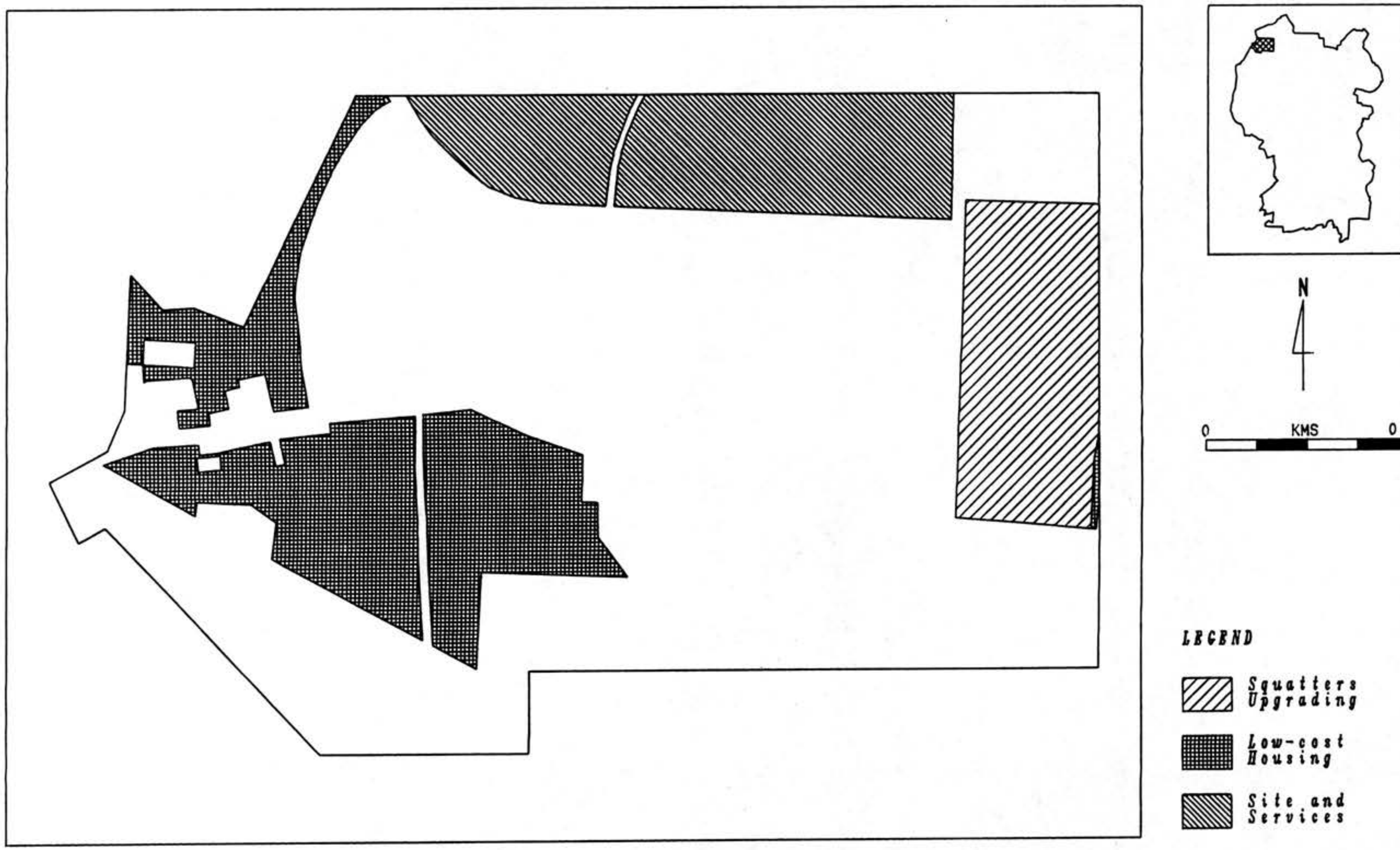
LEGEND
Squatters Upgrading
Low-cost Housing
Site and Services
Compiled by Ahris Yaakup on ARC/INFO, July 1990

JINJANG/KEPONG SQUATTER SETTLEMENT
ALTERNATIVE PROPOSAL 2

Figure 8.11



Compiled by Ahris Yaakup on ARC/INFO, July 1990

assumed density (used in the cost-benefit analysis) this alternative can accommodate 8675 houses to cater for 45,000 people. It is apparent that all of the existing squatters can be accommodated as well as housing future requirements.

8.6.3 Alternative 3

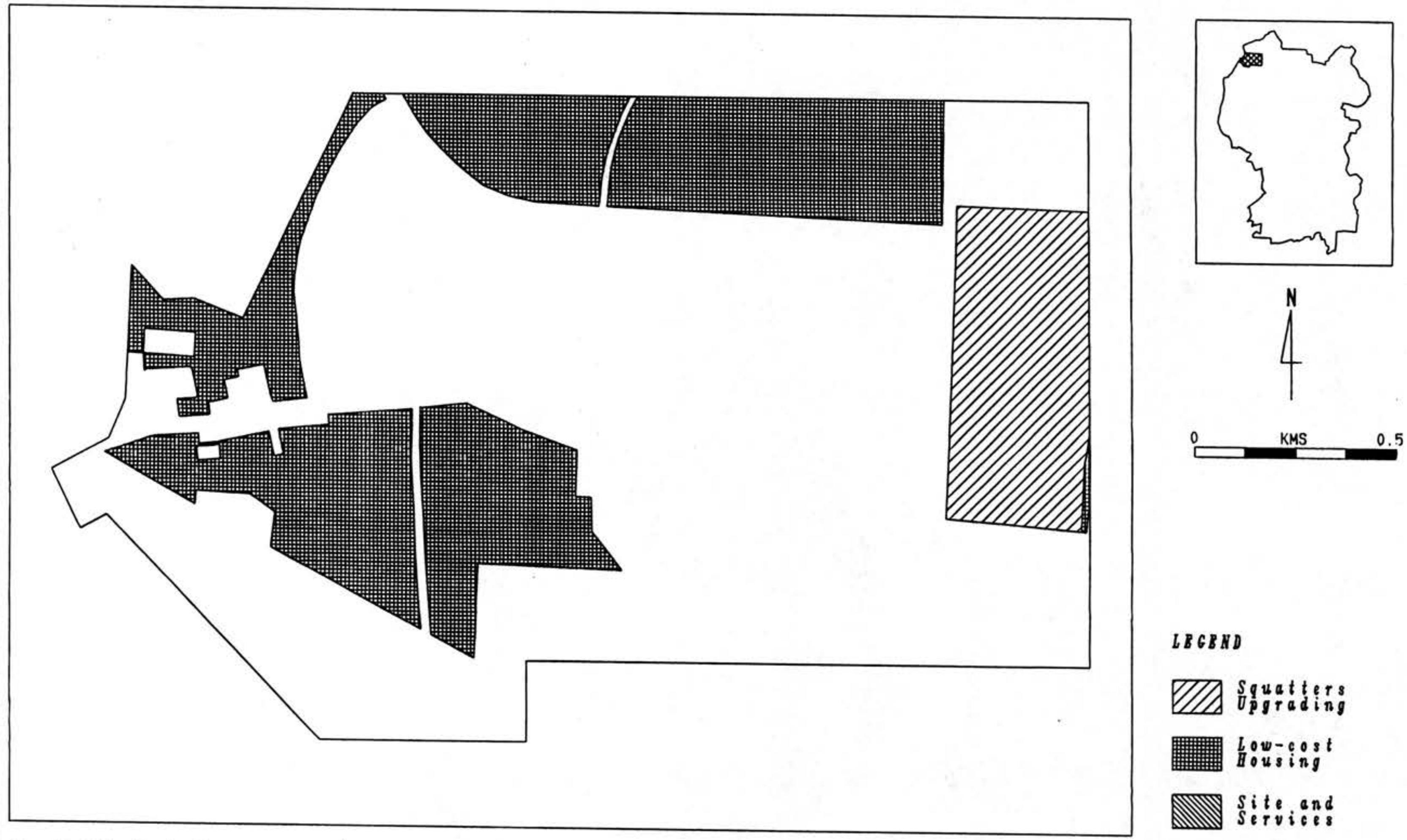
This alternative concentrates on an upgrading scheme and low-cost housing. It does not include the site and services option, which is considered to be least popular to the local authority, in terms of its cost and administrative overhead.

For the upgrading scheme, the area selected is the same as in Alternative 2. For low-cost housing, the area selected will have to be subject to the following criteria: it is owned by the government; it has been zoned as housing; and the existing density is less than 30 units per hectare. The last criterion is included to justify the cost of resettlement. The logical expression is given in Appendix F(d).

The selected area is diplayed in Figure 8.12. Only 1518 houses will need to be relocated in this alternative. The area to be developed with low-cost housing will accommodate 7859 houses, sufficient to cater for the rest of the squatter families as well as future requirements.

JINJANG/KEPONG SQUATTER SETTLEMENT
ALTERNATIVE PROPOSAL 3

Figure 8.12



Compiled by Ahris Yaakup on ARC/INFO, July 1990

8.6.4 Alternative 4

Alternative 4 is basically similar to alternative 2 i.e. mixed development combining an upgrading scheme, site and services, and low-cost housing. However, emphasis will be given to the upgrading scheme. This will allow more low-income earners to own a house, as it involves minimal investment. It will also help to reduce the social disruption as more squatters will continue to stay in their present houses.

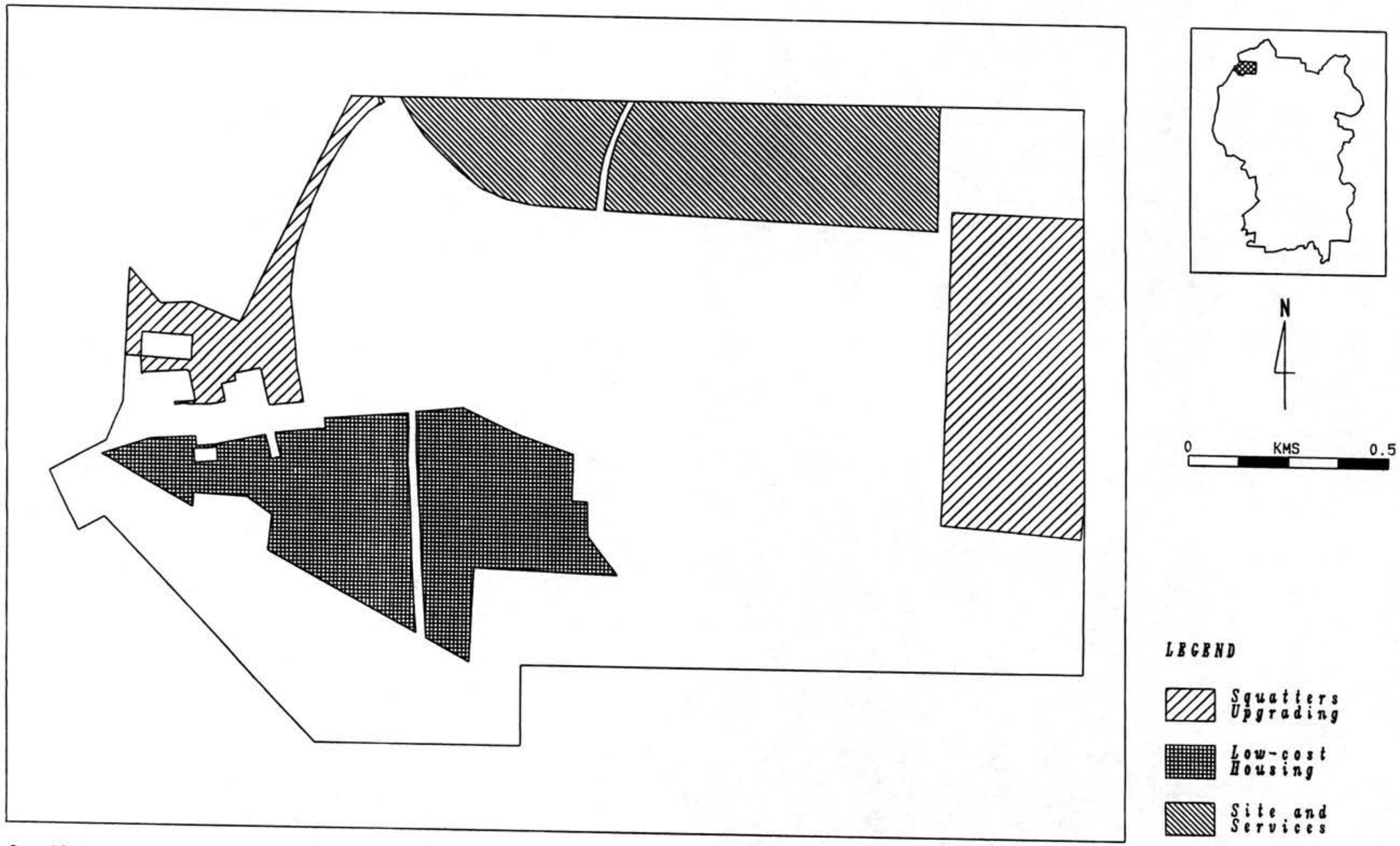
The criteria used to select areas for this alternative will be considerably relaxed as compared to those used in alternative 2 or 3. For the upgrading scheme, the same criteria as in alternative 2 will apply. However, it should also include areas with land values of less than $5.00 per square foot and existing densities of more than 20 units per hectare.

In selecting area suitable for low-cost housing the criteria also include government owned land, land valued at more than $5.00 per square foot, or, land valued at more than $3.00 with an existing density of less than 20 units per hectare.

For the site and services scheme, the selected areas will include those with land valued at less than $1.00 per square foot with an existing density of less than 10 units per hectare. Logical expression for alternative 4 is

JINJANG/KEPONG SQUATTER SETTLEMENT
ALTERNATIVE PROPOSAL 4

Figure 8.13



Compiled by Ahris Yaakup on ARC/INFO, July 1990

given in Appendix F(d).

The resulting plan shown in Figure 8.13 indicates that 32.47 hectares is suitable for low-cost housing, 23.3 hectares for site and services and 27.87 hectares for upgrading. The programme will only require 1421 houses to be relocated i.e. the least number compared to other alternatives.

8.6.5 Evaluation of Planning Scenarios

Having discussed the various alternatives, it is necessary to evaluate them according to their effectiveness, in terms of their cost, benefit, net present value, cost-benefit ratio, number of houses created, number of households to be resettled and number of self-help houses. It should be pointed out that in addition to development cost, each alternative will also include resettlement expenditure which is calculated at $15,000 per household. This will be in the form of provision of houses/land at a subsidised cost ($10,000 per household), transport costs and the provision of temporary accommodation in the form of long houses or City Hall flats. (Refer to Appendix K for detailed computations of the costs and benefits of the plans).

A better understanding of the effectiveness of each alternative can be gained by tabulating the factors involved in the evaluation (Table 8.10). Several significant points emerge. It shows that Alternative 1 require the highest investment cost as well as the highest NPV. It has, however, the lowest cost-benefit ratio. It also requires the whole squatter population to be resettled and more significantly it does not hold any potential for self-help housing. The second alternative has a relatively lower investment cost with a higher cost benefit ratio. In term of housing provision, this plan will create quite a large number of houses. Alternative 4 involves the lowest investment cost and the lowest benefit. In this plan, the least number of people will be relocated. The plan also accommodates the largest number of self-houses. However this will involve land with a relatively high value to be developed as self-help houses. Such an uneconomic use of land is not favoured by the local authority.

Table 8.10: Comparison of Alternative Proposals

Alternative	Cost ($)	Benefit ($)	NPV ($)	Ratio	Hous. Prod.	Hous. Reset.	Self-help Houses
Alternative 1	433.74	595.65	161.90	1.37	9257	2134	0
Alternative 2	294.38	453.80	159.42	1.54	8675	1581	3841
Alternative 3	358.51	499.98	141.47	1.38	7859	1581	553
Alternative 4	249.76	394.81	145.05	1.58	8179	1421	4078

Source : Cost-Benefit Analysis and the Jinjang/Kepong Squatter GIS, 1990

Overall, the most favourable alternative would be Alternative 2. Compared to other alternatives, Alternative 2 fulfills the requirement of a good planning solution. It requires relatively low investment cost, but the benefit is high in term of carrying capacity, self-help houses and the cost-benefit ratio. Although Alternative 1 accommodates the highest number of houses, the cost-benefit ratio is low and the project will require the whole area to be cleared. Except for cash flow benefit, Alternative 3 has no other advantages over Alternative 2. Although Alternative 4 has many advantages over Alternative 2, its weakness is the uneconomic use of urban land. Compared to the other alternatives, Alternative 2 thus, offers the most advantage as its moderate approach will help to balance the burden of the authority and the squatters.

8.7 Conclusions

It is evident that many inter-related factors will have to be considered in solving the squatter problem. This chapter has been devoted largely to the possibility of having a number of options open to the decision-maker, to be evaluated before making the final selection. The study further demonstrates that with the available GIS, circumstances can be avoided where the squatters, as well as the authority, risk mistakes by making piecemeal decisions, because of a lack of proper perspective.

In the planning evaluation process, it is important to have several alternatives, in which various factors such as the cost-benefit and the socio-economic characteristics have been taken into account. In the past, the number of alternative planning scenarios was rather limited due to the difficulties of producing them. This is mainly due to the time-consuming procedure of creating scenarios as well as the evaluation that follows.

The use of GIS as a data management and analysis tool provides several benefits that are not just theoretically attractive but enhance the actual results of the study. Having prepared the evaluation model, the operation can be accomplished within a much shorter time frame by computer processing of the data and computer mapping of the results.

The approach also brings increasing rationality to the decision-making process. Since the geographic information is stored and processed in its primary form, analysis can be more quantitative and rational. The modelling stage, for example, requires planners to make explicit their criteria for the selection of alternative programmes. This encourages the selection of objective criteria, based on real data about the area under study.

Automation also makes it possible to avoid the drudgery and minutiae characteristic of many manual approaches to urban planning. Instead it allows concentration on performing as professionals: creating ideas, making judgements, pursuing possibilities, proposing alternatives for decision-makers. Finally GIS allows the display of most of the raw data that were used in arriving at the reported conclusions. it also allows the decision process and its results to be more fully revealed through graphic displays of intermediate and final results.

Notes

1 Cluster link houses comprise four units of terrace houses clustered together and joined by a common 8 feet (2.4 meters) breezeway. Each unit opens into the breezeway and faces each other directly.

2 Relative Inflation Rate, f, are based on a 10 year average of Consumer Price Index (1985 - 1990) given by the Department of Statistics, Kuala Lumpur.

3 Based on average housing density of selected area for resettlement in the Jinjang/ Kepong.

4 Based on the existing average housing density in the Jinjang/Kepong Squatter Settlement.

CHAPTER 9

AN INTERACTIVE APPROACH TO SQUATTER PLANNING

9.1 Introduction

Despite the proliferation of advanced equipment and software in GIS technology, there are still many constraints on the use of GIS in urban and regional planning, which limit their effective application. Scholten and Padding (1990) point out that GIS systems are not advanced enough for mainstream urban policy making because of the rather limited possibilities for analysis built into them. Also, the systems are rarely user-friendly. They could be positively terrifying for ordinary citizens who would like to use data they contain in making informed responses to government policies. A filter between their professional use and their use as a public information sytem is clearly required. Hence, there is a need to integrate existing analytical techniques and GIS packages by adding modelling software directly into such GIS software or developing easy-to-use interfaces with already developed planning models (Openshaw, 1987; Worrall, 1989; Harris, 1990; Brail, 1990).

In terms of cartographic modelling, the expanding field of computer cartography has now allowed GIS users to be more ambitious. Developers of specialised application software have made substantial progress in combining graphics-oriented problem solving with spatial databases (Douglas, 1982; Openshaw et al., 1986; Openshaw and Mounsey, 1987). Calkins (1984) provides examples of dynamic simulation through computer graphics with interactive display techniques, which allow the analyst to view the data in various ways. Other examples include a prototype interactive graphics system which aims to integrate several fields like GIS, spatial analysis and operational research, graphics workstation technology, and an expert system framework for problem solving (Horn et al., 1988). With the current facilities in GIS, there is therefore the possibility of developing user specific application programmes.

It is the aim of this chapter to examine and develop an interactive graphics user interface for squatter planning and management. The interface will be designed for users in the planning community as well as personnels of the proposed squatter department (see Chapter 3). It will focus on the use of the Arc Macro Language (see Chapter 4) to facilitate user access to alternative squatter planning scenarios. The interface is expected to provide flexibility in data selection and display, to allow physical planners and decision-makers to view and analyse the planning scenarios interactively before deciding on the final plan. This chapter will also examine the use of interactive layout design as regards the provision of basic infrastructure in the squatter upgrading programme.

9.2 The Need for Interactive Planning Scenarios

Physical planning covers a wide range of applications, and is characterised by the integration of different policy sectors within a spatial framework. Effective physical planning can only be carried out if there is enough information at hand. In this context, the value of a GIS is its potential in reducing the uncertainties involved in decision-making by providing extensive, accurate and timely information to be utilised in this process.

At present, the use of GIS in the field of planning is predominantly amongst the information specialists. Physical planning however, is not merely a task for physical planners and researchers but is also part of the political and public decision-making process (van der Muelen, 1984). Up to now, the application of computer automation has been very limited for policy decision makers, who have, in general, little affinity with, or knowledge of, computer automation and statistical methods and techniques. Development of intelligent user interfaces will make GIS systems responsive to user needs, while the user will no longer have to become an expert in the use of GIS in addition to their own field of specialisation.

In the past ten years there has been a substantial increase in the scope and capabilities of GIS. A significant technological aspect of these developments is the emergence of interactive graphics workstations as primary working platforms for GIS, typically in a networked computing environment. The display and interactive features of the workstations provide the basis for an effective dialogue between planners and spatial problems; while the computing power available makes possible the provision of modelling procedures as elements in that dialogue. The computer generated cartographic displays and statistical analyses represent a very important aspect of the overall decision support system.

When decisions are to be made, alternative options should be provided for decision-makers to choose from. This is the rational planning model, as proposed by Simon (1976). Information required for this rational planning process includes the characteristics and consequences of alternative options and knowledge about goals and planning values. An interactive problem-solving framework will give the user the potential to ask "what-if" questions. The formulation of an answerable question is often obtained in an iterative manner by "trial and error". Consequently an information system should facilitate such a heuristic dialogue (de Man, 1988). Using an interactive framework, decision-makers should be able to see a cartographic representation of the consequences of different planning scenarios. In addition to this, evaluation techniques such as those based on cost-benefit analysis can be made more accessible.

9.3 Implementation of an Interactive Planning System for the Jinjang/Kepong Squatter Settlement

An important issue in squatter planning and monitoring is to predict the likely impacts of certain planning decisions on the squatters and assess the feasibility of new proposals. Squatter planning processes usually involve various parties (local government, squatters, politicians). In practice the planners will consider the different needs of the people involved and try to incorporate them into the planning proposals. A number of scenarios will have to be considered and the impacts of such scenarios assessed. The findings will then be used to support the decision-making process by way of input to the discussions or negotiations with the various parties. Alternatively they may be used to formulate additional scenarios.

The management side of squatter planning involves the planner and the planning process not simply in the implementation of plans, but also in the on-the-spot decisions which are often necessary to harmonise particular decisions with general directives. Management therefore requires not only quantitative reasoning but also a great deal of qualitative reasoning (Han et al., 1989).

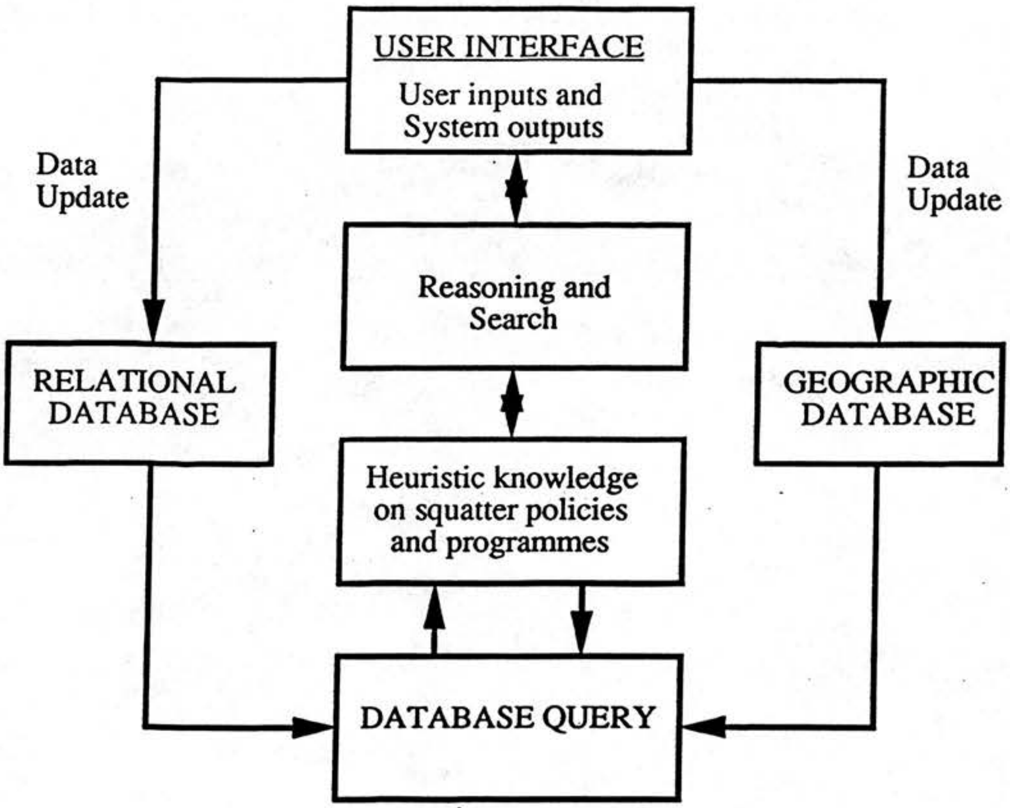


Figure 9.1 : Schematic Structure of Interactive Squatter Planning

Based on the above planning and management requirements, a schematic structure of how squatter planning scenarios can be undertaken interactively was drawn up (Figure 9.1). In this process, the operator of the system uses his/her knowledge about squatters to suggest policies and programmes for the squatter area. Using logical query expressions, appropriate policies and programmes can be selected for a specific area. These can then be evaluated using the chosen criteria. The process can be done repeatedly to assist with the on going discussion, and each plot can be saved for comparison before the decision is finalised.

9.3.1 Creating A Menu Interface with AML

In designing a user interface for the squatter planning GIS, menu and command line options were chosen, together with the use of SQL for query purposes. In the menu interface, all the options are displayed on screen in a carefully controlled environment which is particularly suited to the novice user. Using menus together with a command line option, which provides a faster means of interaction, allows the requirements of more expert users to be addressed also. SQL query facilities are made available for flexible query of the squatter database. Basic SQL is simple to use but complex queries can also be constructed. It is assumed that the user has some knowledge of what results are required and how to achieve them, so some preliminary background in the nature of GIS methods would have to be provided to potential users before giving them access to the system.

A screen-based menu system is the key to a user-friendly interface at the top level. This should allow the maximum amount of information to be extracted from the system with a mimimum amount of computer expertise. All the possibilities should be displayed on the screen, so that with the use of only three keys (two arrows and the return key), or a "mouse", choices can be made.

The facilities within AML have made it possible to create the customised menu-driven front end system for squatter planning applications. The menu facilities provide an environment to group together several actions into one selection procedure. This can reduce the number of input commands by the user (in effect reducing the possibility of typing errors) and to allow input data to be verified before proceeding to the next stage. In this way, the user can gain access to a large and diverse database and make use of the graphic capabilities of a GIS without full familiarity with the ARC/INFO package and all its functionality. In addition AML provides several tools that can be used to present a standard, dialogue based user interface.

The menus are typically listings of choices and comprise a display of keywords and phrases associated with an action e.g. running another AML or calling a further menu to be displayed. A number of screen menu formats are available to tailor the screen presentation. In designing the curent system, three types of menu have been used, pull down menus, form menus and matrix menus.

a) The main menu was designed based on a pull down menu format. This type of menu appears as a bar across the top of the screen from which choices are pulled down (Figure 9.2). The user can select any one of the choices given in the menu. Each option in the menu, when selected, calls the individual AML programme or action to be activated. The experienced user can also give additional ARCPLOT commands from the key board or quit from the main menu (Appendix L).

b) A form menu was used for the purpose of coverage reselection (Figure 9.3 and Figure 9.4). This menu can be designed flexibly depending on how one wants the menu to interact with the user. Each menu can not only have a completely individual look but the display of the menu can change as the user interacts with the form. This menu was selected to enable the user to type in data at the keyboard as well as making a selection from a series of options displayed on the screen. In this study, the form menu is used to enable the user to key in criteria available in the squatter database for selecting a specific squatter programme. At the same time the user can also make a selection from a set of choices that is being displayed. The result of a selection might run another AML programme or perform some other desired actions (Appendix N).

c) A matrix menu was used to list the items in individual datafiles and the item values (Figure 9.5). The menu appears as a series of choices, in a box that may be positioned with a degree of flexibility within the dialogue area. In this study, the matrix menu helps the user to list item values for selected polygons (Appendix O).

9.3.2 AML Programming

The design of the interactive squatter database query is based on the following principles:

a) The system should have an interactive graphics interface so that the geographic dimension of the data can be clearly and quickly seen; and

b) The use of a standard query language such as the Structured Query Language (SQL). This is necessary to select from the database on a selected item.

The implementation of interactive squatter planning scenarios involves AML programming. An extensive set of AML directives and functions will be used in the programme. The AML programme will be run by the operating system command (SQPLAN.COM) which will execute the main programme (Appendix L). The main programme is called SQPLAN.AML (Appendix P). When executed the SQ.PLAN.AML calls the main menu (SQPLAN.MENU) which lists a set of policies and programmes for the squatters (Figure 9.2 and Appendix M).

Figure 9.2: The Main Menu (SQPLAN.MENU)

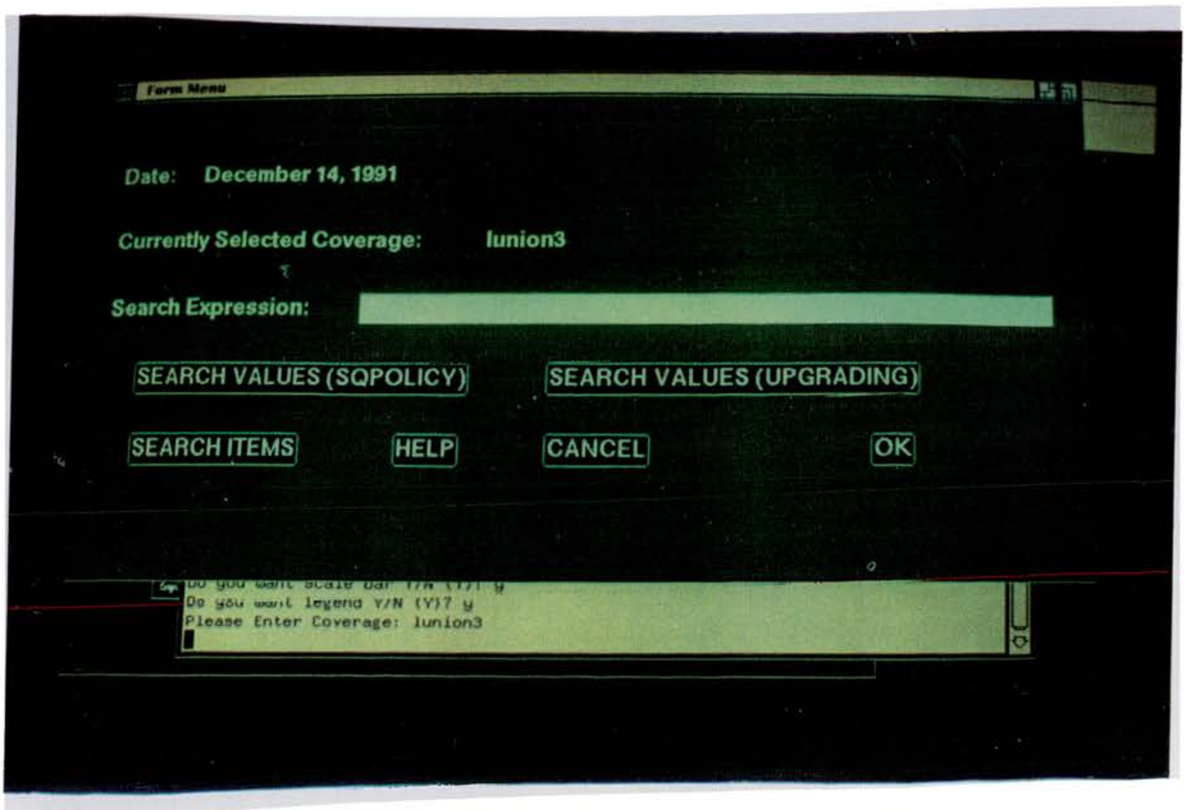


Figure 9.3: ARCPLOT Reselection Menu (RESEL.MENU)

Figure 9.4: Reselect Menu and Display of Selected Area

Figure 9.5: Matrix Menu for Search Items

There are 3 major programmes involved:

1 Squatter Policy (SQPOLICY.AML) - This allows areas for specific squatter policies (resettlement, improvement, upgrading or no action) to be selected (Appendix Q). It also calculates the area and cost-benefit of the policy;

2 Housing Policy for Squatters (HSPOLICY.AML) - This allows areas to be reselected for a specific housing policy (low-cost housing and site and services) and calculates the area and cost-benefit of the policy (Appendix R);

3 Upgrading Programme (UPGPROGR.AML) - This allows reselection of squatter buildings for demolition, reselection of houses for the provision of housing loans for improvement, or reselection of households to be encouraged to move out of the squatter area. It also calculates floor area and the number of people involved (Appendix S).

When the corresponding programme is called, AML passes a parameter value from the menu. For example,

```
RESETTLEMENT &RUN SQPOLICY.AML 1
```

This parameter is stored in the variable MENUVALUE in SQPOLICY.AML. The SQPOLICY.AML executes the &SELECT with the MENUVALUE parameter which allows the execution of the statement whose value matches the value stored in MENUVALUE. For example,

```
&SELECT   %.menuvalue%
 &WHEN 1
  &DO
   &IF [query 'Shade selected polygons Y/N (Y)' .TRUE.]
        &THEN
    polygonshade %.rescov%% 50
   &IF [query 'Do you want summary statistics Y/N (N)'
        .FALSE.] &THEN
    &DO
     &TYPE Summary statistics for coverage %.rescov%
      statistics %.rescov% %covsort%
      sum AREA_H
      end
     &END
    &END
  &END
```

This programme will select the area for a resettlement programme and display the graphics and statistics if desired. During the execution of SQPOLICY.AML, it calls the RESEL.MENU (Figure 9.3 and Appendix N). The RESEL.MENU allows the user to select a set of coverage features (based on the selected coverage PAT file) in response to the search expression. If the user is uncertain about the coverage features and how to state the ARCPLOT logical expression, he/she may also select any directive from the list of choice displayed by RESEL.MENU. The list of choice includes SEARCH ITEMS, SEARCH VALUES (SQ POLICY), SEARCH VALUES (UPGRADING), HELP, CANCEL AND OK. The SEARCH ITEMS, SEARCH VALUES and HELP options will aid the user in responding to the search expression. The SEARCH ITEMS option will &RUN SERIT.AML which includes the following ARCPLOT commands:

```
ITEM %.rescov% %.covtype%
```

The above command displays the items of the selected coverage. The options for search values (SEARCH VALUES (SQ POLICY) and SEARCH VALUES (UPGRADING)) list down the items in the selected coverage for squatter policy and upgrading programmes (Appendix T and Appendix U). When one of the items in the menu is selected, it will list the value of the item and its description (Appendix T and Appendix U). The SEARCH ITEMS and SEARCH VALUES will help the user to formulate the reselect expression for selecting the area for a specific squatter policy and programme. If the user selects the HELP item in the RESEL.MENU, the help text can also be displayed in the popup window (Figure 9.6).

The whole operation can be repeated using other selection criteria. This provides flexibility for the user to select the area for a specific squatter policy. If desired the user can ask for the statistics of the selected area (e.g. acreage, cost and benefit of development) to be displayed on the screen. Cost and benefit of any specific project has also been included as one of the items in the INFO datafile. The cost and benefit of each programme has been fixed on a per hectare basis. When AML is asked to display the statistics, the total acreage of the area of the selected programme will be multiplied by its cost and benefit and this will be

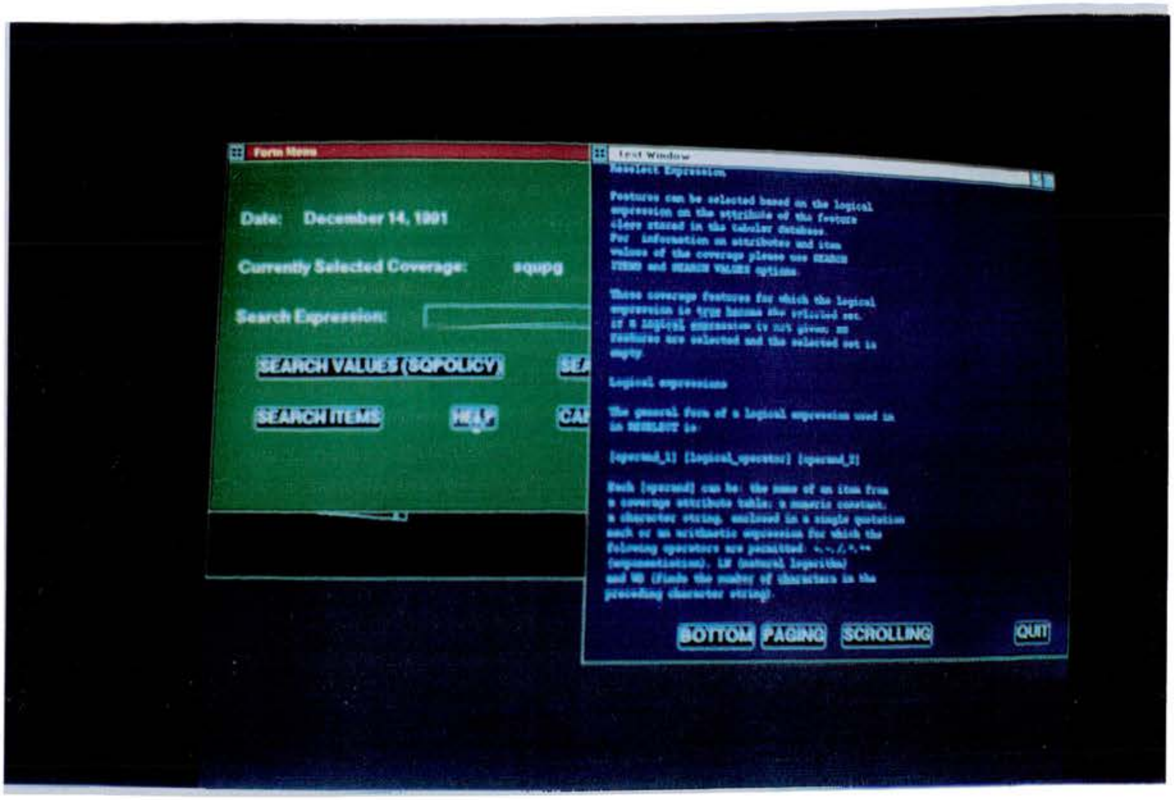


Figure 9.6: Display of Text File

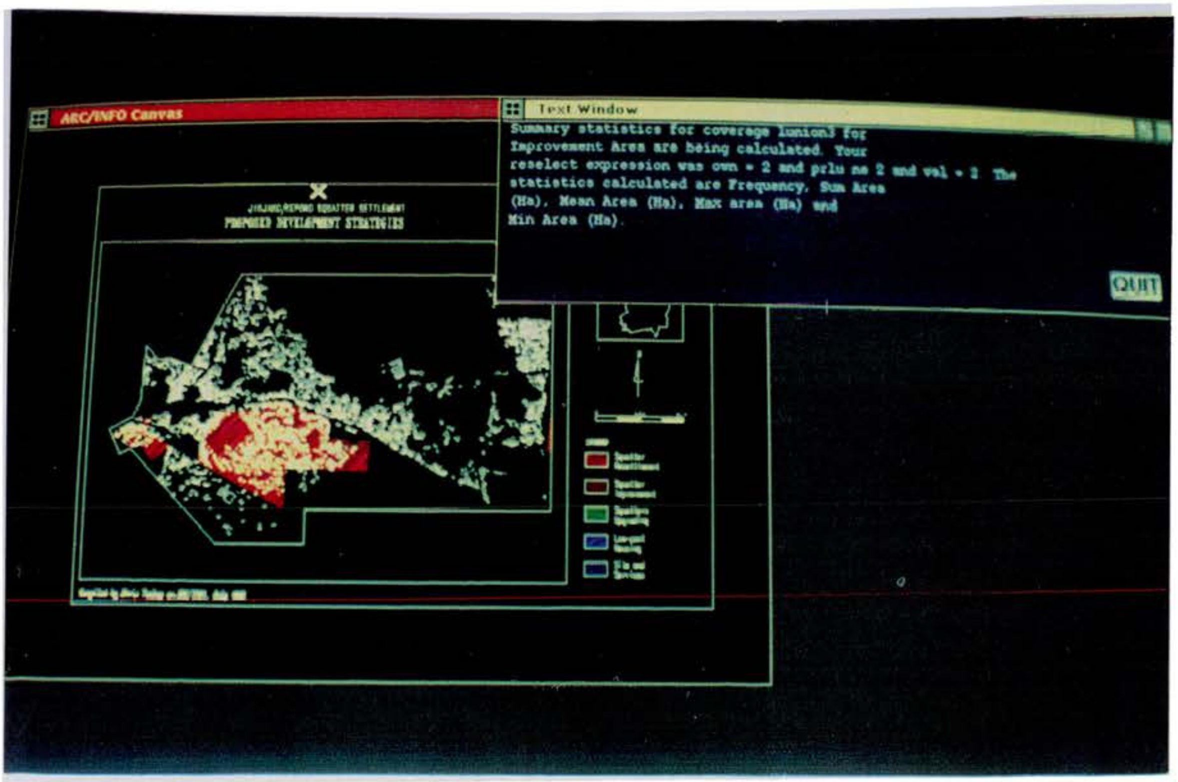


Figure 9.7: Integration of Text and Graphics

displayed on the terminal. Any selection can be saved and plotted for the final output. This kind of heuristic dialogue will provide a more flexible model for obtaining solutions which can be retrieved and examined in a timely fashion. Several results of the operation will be discussed later in the chapter.

There is some user interaction provided which consists of a dialogue that prompts the user to continue or exit. This provides the user with ample opportunity to select options for graphics or statistical display. There is also an interactive ARCPLOT RESELECT for more expert users to select the area for a specific squatter programme according to criteria of their choice. It also utilises popup windows for the display of text files, INFO files and the menu. The use of popup windows allows the integration of text and graphics, since popup windows do not erase the screen when they are displayed. An example of this integration can be seen in Figure 9.7. The popup windows can be placed in almost any location on the screen. They also have their own scrolling commands which allow movement through the text at the user's discretion. This provides greater flexibility and more control over the system.

9.4. Evaluation of Alternative Squatter Policies

The AML programme for squatter planning scenarios was designed for novice users in the planning community and the proposed squatter department, with some additional facilities for those with more GIS experience. It is assumed that the novice group has some background knowledge in database management and the use of a key board. When running the programme, it will first ask the user to select the specific database for operation. It also has a help option and other help facilities i.e. SEARCH ITEMS and SEARCH VALUES. An advanced user can give other ARCPLOT input from the keyboard. If the user is not sure about the items in the data files and their description, the SEARCH ITEMS will list all the items and their description in the currently selected coverage. For example, item OWN is the land ownership. The value for an individual item can be listed when the user select the item from the item list in the matrix menu (Figure 9.5 and Appendix O). This will help the user to formulate reselect expressions.

9.4.1. Squatter policies

The selection of squatter policies can be performed by selecting any of the SQ_POLICY options from the main menu. The SQ_POLICY.MENU will list the detailed squatter policies (Resettlement, Improvement, Upgrading and No_Action). The selection of any of the policies will activate the SQPOLICY.AML (Appendix Q).

Therefore, the selection of,

Resettlement will &RUN SQPOLICY 1

Improvement will &RUN SQPOLICY 2

Upgrading will &RUN SQPOLICY 3

No Action will &RUN SQPOLICY 4

Assuming the user's selection to be:

RESETTLEMENT

If the selection criteria are high land value (higher than \$3.00 per square foot); and government owned land; then the logical expression is (see Appendix F for item definitions and item values),

```
OWN = 2 AND VAL GT 3
```

IMPROVEMENT

If the selection criteria are government owned land; land not proposed for housing in the future but not going to be developed within the next five years; and land value less that \$3.00 per square foot; then the logical expression is,

```
OWN = 2 AND PRLU NE 2 AND VAL LE 2 AND PRLPD = 4
```

UPGRADING

If the selection criteria are government owned land; land proposed for housing; and land value less than \$3.00 per square foot; then the logical expression is,

OWN = 2 AND PRLU = 2 AND VAL = 2

The combined selection will display the output as shown in Figure 9.8. The user can view the selected area and the corresponding statistics as shown in Table 9.1.

Table 9.1 : Area of selected policy

Squatter Policies	Area (Hectares)
Resettlement	38.3
Improvement	39.4
Upgrading	26.7
Total	104.4

Source: Jinjang/Kepong Squatter GIS, 1990

9.4.2 Alternative Housing Policies for Squatters

The Kuala Lumpur Structure Plan has noted that certain squatter settlements have the potential to be developed as a planned housing estate or other kinds of development (DBKL, 1984, p.118). In consequence, a number of squatters will have to be resettled in other areas. Such action requires the local authority to find alternative housing for the squatters, taking account of their financial status and locational factors, such as the distance to the work place.

The local authority may therefore have to consider the possibility of developing the areas which are currently occupied by the squatters or the nearby areas. Such

Figure 9.8: Proposed Development Strategies

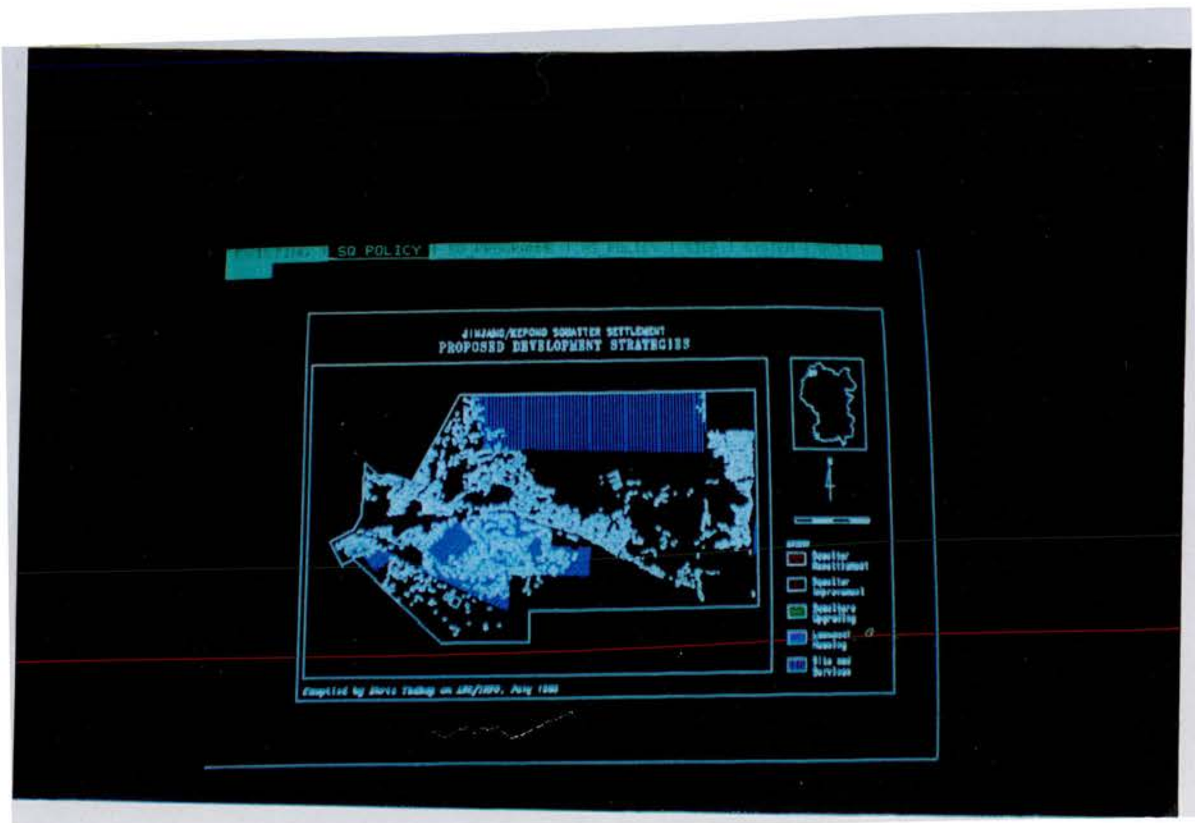


Figure 9.9: Alternative Housing for Squatter

alternative housing, however, will have to be evaluated in terms of the socio-economic background of the squatters involved in the programme, as well as its cost and benefit.

For the Jinjang/Kepong settlement, vacant land, including land which has been vacated by the squatters, and ex-mining land (after improvement) is recommended to be used for permanent alternative housing for the squatters.

At this stage, the detailed strategy of the development is still open for discussion. The use of an interactive graphics framework will provide the platform on which the people involved in the programme, such as the local authority, the developers and the squatters can participate.

In this interactive framework, the selection of alternative housing policies can be done using the HSPOLICY option available from the main menu (SQPLAN.MENU) which will &RUN HSPOLICY.AML (Appendix R). HSPOLICY will list the following policies, (1) low-cost housing; and (2) site and services. Therefore, the selection of,

Low-Cost will &RUN HSPOLICY 1

Site and Services will &RUN HSPOLICY 2

The user can then give the selection criteria using the RESEL.MENU. Figure 9.9 shows an example of the output of the operation. It displays the area selected for Low-

Cost Housing and Site and Services based on the following selection criteria:

i) Low-Cost Housing

The selection criteria are government owned land; proposed future land use of housing; and land value greater than $5.00 per square foot. The logical expression is,

OWN = 2 AND PRLU = 2 AND VAL GE 3

ii) Site and Services

The selection criteria are government owned land; proposed future land use of housing; and land value less than $1.00 per square foot. The logical expression is,

OWN = 2 AND PRLU = 2 AND VAL = 1

For the purpose of evaluation, the cost and benefit of these projects can be interactively retrieved by the ARCPLOT STATISTICS which will display the total sum of cost and benefit according to the areas. Table 9.2 shows the statistics for the above projects derived from the operation.

Table 9.2 : The Statistics for Alternative Housing Policies

Alternative Policies	Area (hectare)	Cost (mill $)	Benefit (mill $)	B - C (mill $)
Low-Cost Housing	47.7	230.2	340.0	109.8
Site and Services	34.7	71.8	178.4	106.6

Souce: Jinjang/Kepong Squatter GIS, 1990

Other alternative scenarios can be produced by repeating the operation using other selection criteria in RESEL.MENU. The user therefore is able to examine a number of scenarios before the final selection is made.

9.5 Interactive Evaluation of the Squatter Upgrading Programme

In Chapter 8, certain areas of the Jinjang/Kepong settlement were selected for the upgrading programme. This is based on the argument that this area is zoned for housing and appropriate in terms of land cost and current housing density. The upgrading programme involved the provision of basic infrastructure, demolition of dilapidated houses, improvement of old houses and relocation of industries.

Before the actual programme can take place, the affected area and buildings need to be critically examined. The affected buildings to be either demolished or improved or relocated, will have to be identified, in addition to planning for the provision of basic infrastructure. It also needs to identify families who have substantial income to be encouraged to move out of the area.

9.5.1 Selecting Buildings for the Upgrading Programme

Squatters and buildings which are affected by the upgrading programme can be selected interactively using the option SQ_PROGRAM which lists the following choices:

```
Demolition &RUN UPGPROGR.AML 1
Improvement &RUN UPGPROGR.AML 2
Move_out &RUN UPGPROGR.AML 3
```

In selecting the first option, the user will be asked to give his/her input for the selection criteria to identify the buildings to be demolished. For example to select the dilapidated houses and squatter industries. The logical statement reads,

```
BUS = 2 OR CON = 4
```

This will select 28 buildings with a total floor area of 3,484 square yards.

Again in the upgrading programme, squatters should be generally encouraged to improve their houses. It is recommended that the provision of loans should be made available for this purpose. By choosing the second option of SQ_PROGRAM, the user can state his/her selection criteria for houses to be improved as well as to identify households entitled to housing loans. In the following example, the selection criteria for housing improvement loans are set for houses whose condition is categorised as "old" and whose household income is less than $600.00. This group of people is felt to be in need of financial support for the purpose of improving their house. The logical expression reads,

BUS = 1 AND CON = 3 AND INC LE 7

In the above example, about 273 houses with a total floorspace of 26,523 square yards were selected.

It should be noted that there are a number of households affected by the upgrading programme whose incomes are more than $1000.00 per month. Such income an is considered to be quite substantial. In accordance with the Kuala Lumpur Structure Plan, they are therefore encouraged to move out of the squatter area (DBKL, 1984, p.118). These households can be selected by &RUN SQPROGR.AML 3. The logical expression reads,

BUS = 1 AND INC = 12

Based on the above criteria, about 15 households will be identified. Detailed information on individual houses (for example, building number, number of people in the house, occupation of the head of household, income and distance to work place) can also be listed using the SEARCH ITEM option.

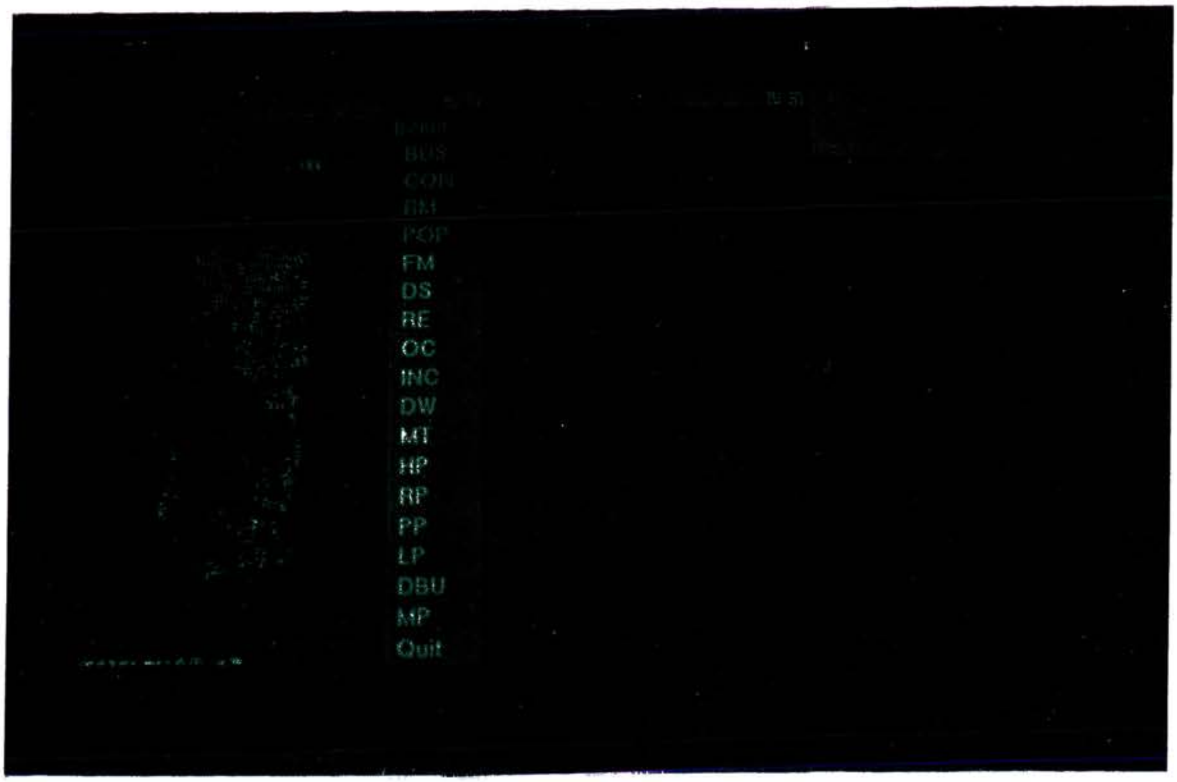
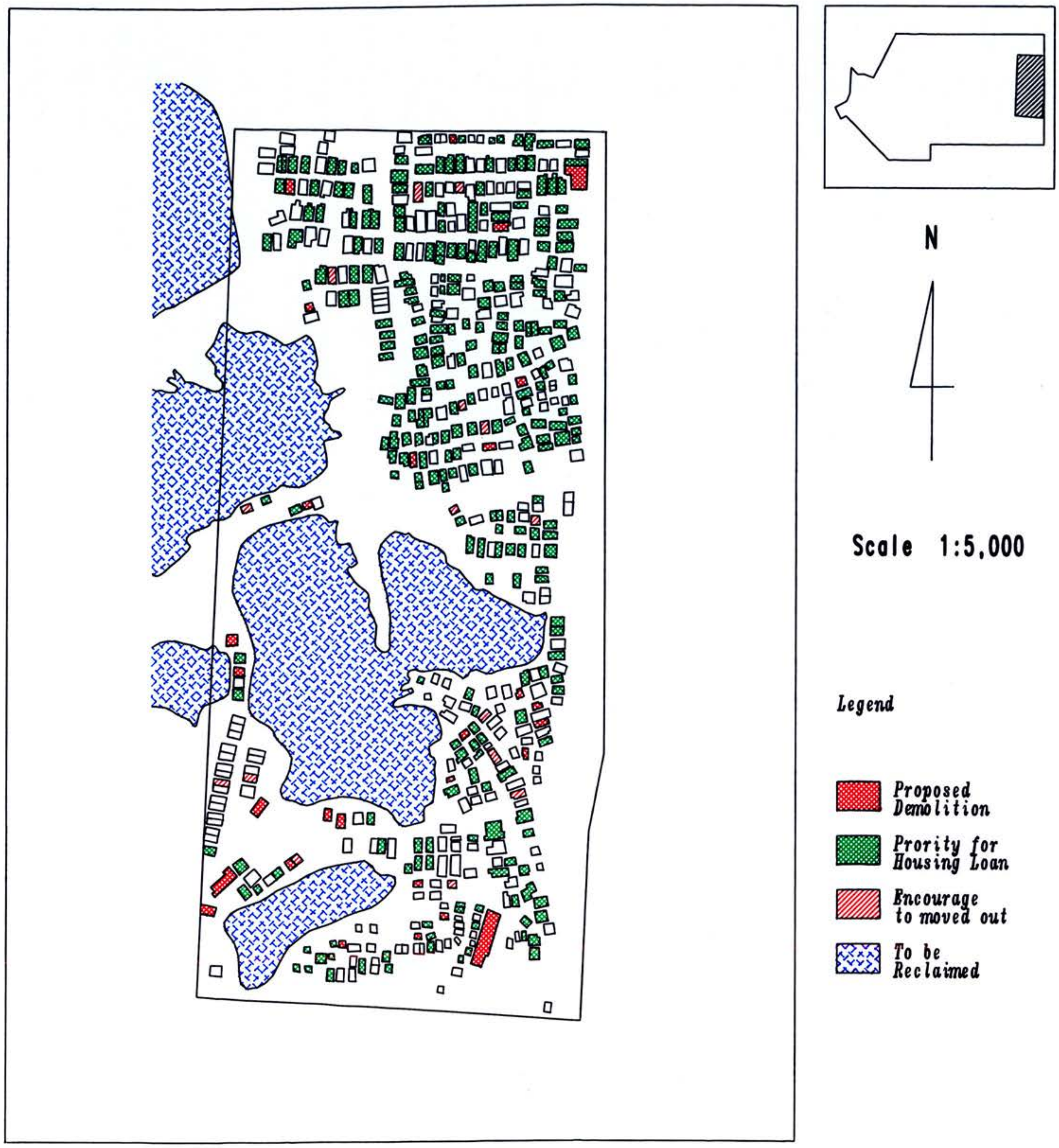


Figure 9.10: Selected Upgrading Programme

Figure 9.11: Interactive Designing: Alternative Roads

Figure 9.12

JINJANG/KEPONG SQUATTER SETTLEMENT
PROPOSED UPGRADING PROGRAMME



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The result of the combined operation is shown in Figure 9.10. In this Figure, the buildings left unshaded are those not selected for the programme. If desired, the statistics on the number of buildings, floor area and number of people involved, can be retrieved and displayed on the screen. Besides the graphics display from the menu selection, the user can give additional ARCPLOT commands from the terminal. In AML, ARCPLOT command can be read from the terminal using the &TTY directive. This enables other information to be included in the graphics output, for example, the ex-mining pond which can be reclaimed. The output can also be saved and plotted as shown in Figure 9.12. As with the SQPOLICY, this operation can also be repeated using other selection criteria thus allowing a heuristic dialogue to be performed.

9.5.2. Provision of Basic Infrastructure

The upgrading programme will also involve the provision of basic infrastructure and services such as paved roads, footpaths, provision of electricity and water supply. The provision of roads will be examined for the purpose of illustrating the use of interactive layout design.

Interactive design can be performed using advanced facilities in ARCEDIT. The user can easily re-design the road network by adding, deleting or modifying the arcs in the road coverage. In an upgrading programme, the road network will have to take account of the existing layout of squatter buildings unlike designing on a vacant site. The advantage of using ARCEDIT for this purpose, is that it allows the road to be designed using the squatter buildings as the backdrop (using the BACKCOVERAGE command) (Figure 9.11). Batch jobs can subsequently be used to create any new topology, or perform buffering and overlay with the squatter database for further analysis of the proposed road network. In a workstation, these batch jobs could be set in motion while the user continues with editing of other design scenarios.

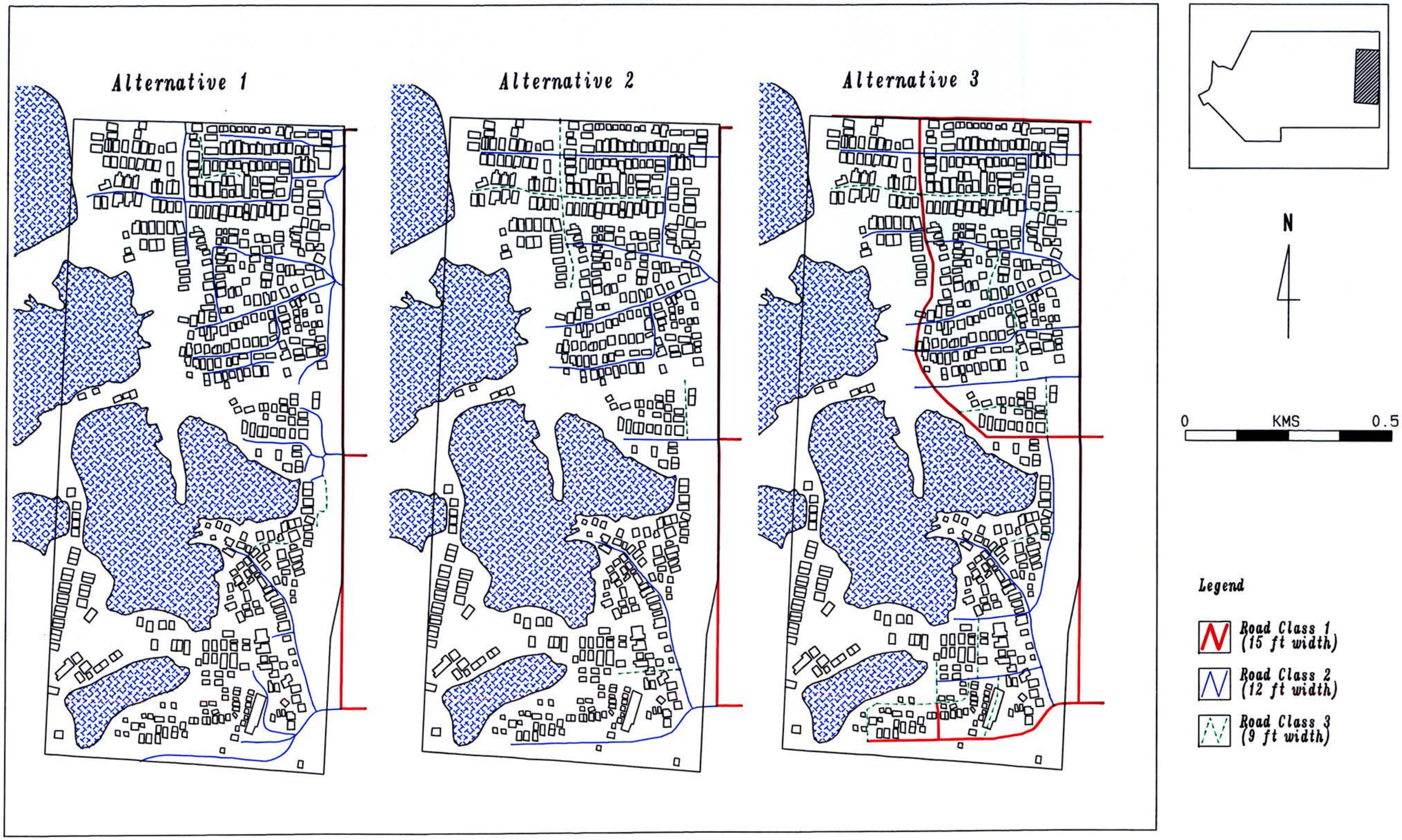
Four criteria were considered in the design: (1) to compromise between maximum accessibility and minimum cost; (2) to integrate the new network into the existing environment; (3) to establish some form of road hierarchy in the area; and (4) to minimise the number of buildings affected by the proposed road alignment.

Three alternative road network designs can be proposed. Alternative 1 focuses on improving the existing roads. No new roads have been proposed to avoid any building having to be demolished. In alternative 2, only the most necessary road segments will be added or improved, to provide accessibility with mimimum cost. Alternative 3 provides a comprehensive road network (Figure 9.13) which aims to provide maximum accessibility.

The alternatives are evaluated in terms of accessibility

Figure 9.13

JINJANG/KEPONG SQUATTER SETTLEMENT
PROPOSED ROAD IMPROVEMENT



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and the cost of construction. Accessibility was measured by generating a BUFFER of 50 feet on both side of the road.(1) Only the houses within the buffer area are considered to be served by the road (Figure 9.14). The cost of contruction can be calculated based on the total length of individual road class.(2) For Class 1, the road width is 15 feet and the construction cost is $55.00 per yard. For Class 2, the road width is 12 feet and the construction cost is $40.00 per yard. For Class 3, the road width is 8 feet and the construction cost is $32.00 per yard. A clear comparison of the alternatives is shown in Table 9.3.

Table 9.3 : Cost estimates for road improvement

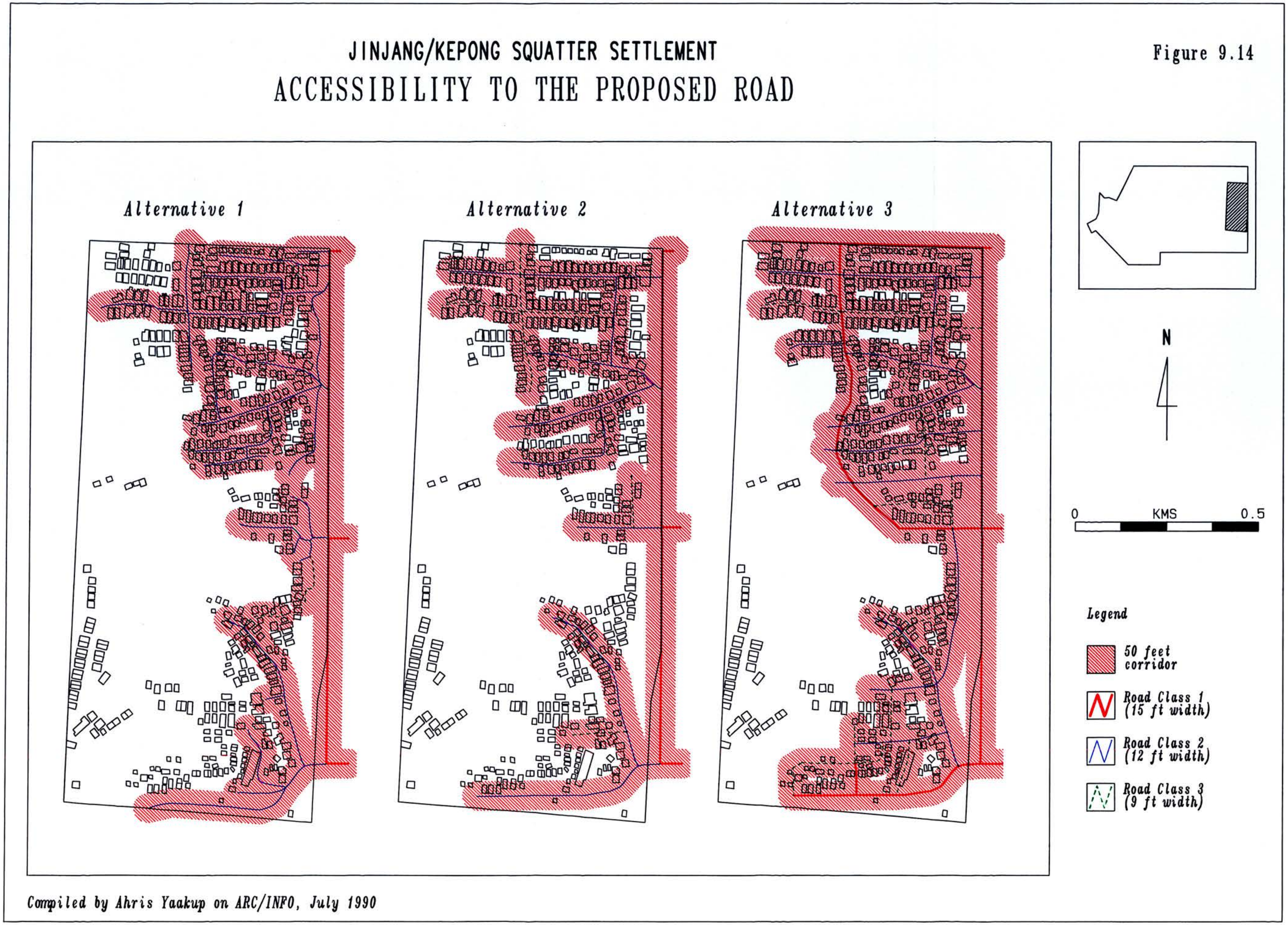
	Alternative 1 length (yards)	cost ($)	Alternative 2 length (yards)	cost ($)	Alternative 3 length (yards)	cost ($)
Road Class 1 (15 ft width)	855.8	47,069	855.8	47,069	2134.8	117,414
Road Class 2 (12 ft width)	3082.2	123,288	1809.5	72,380	2206.2	88,248
Road Class 3 (9 ft width)	267.7	8,566	653.4	20,908	1233.5	39,472
Total	4205.7	178,923	2598.7	140,357	5574.5	245,134

Source: Jinjang/Kepong Squatter GIS, 1990

Table 9.4 : Evaluation of cost and accessibility for various alternative designs

	Total Cost	Accessibility (based on 50 ft buffer) Houses No	%	Family No	%	Population No	%
Alternative 1	178,923	393	74	408	70	2320	70
Alternative 2	140,357	350	66	360	68	2082	62
Alternative 3	245,134	497	93	516	88	2818	88

* % of the total number in the upgrading area
Source: Jinjang/Kepong Squatter GIS, 1990



JINJANG/KEPONG SQUATTER SETTLEMENT
ACCESSIBILITY TO THE PROPOSED ROAD
Figure 9.14
Alternative 1
Alternative 2
Alternative 3
N
0
KMS
0.5
Legend
50 feet corridor
Road Class 1 (15 ft width)
Road Class 2 (12 ft width)
Road Class 3 (9 ft width)
Compiled by Ahris Yaakup on ARC/INFO, July 1990

The total cost of road improvement can be calculated by multiplying the total length of road derived from the database with the estimated cost of construction per yard (Table 9.3). The cost of each alternative can then be compared with the accessibility level as shown in Table 9.4. In this example, alternative 3, notwithstanding the high cost, provides the maximum accessibility.

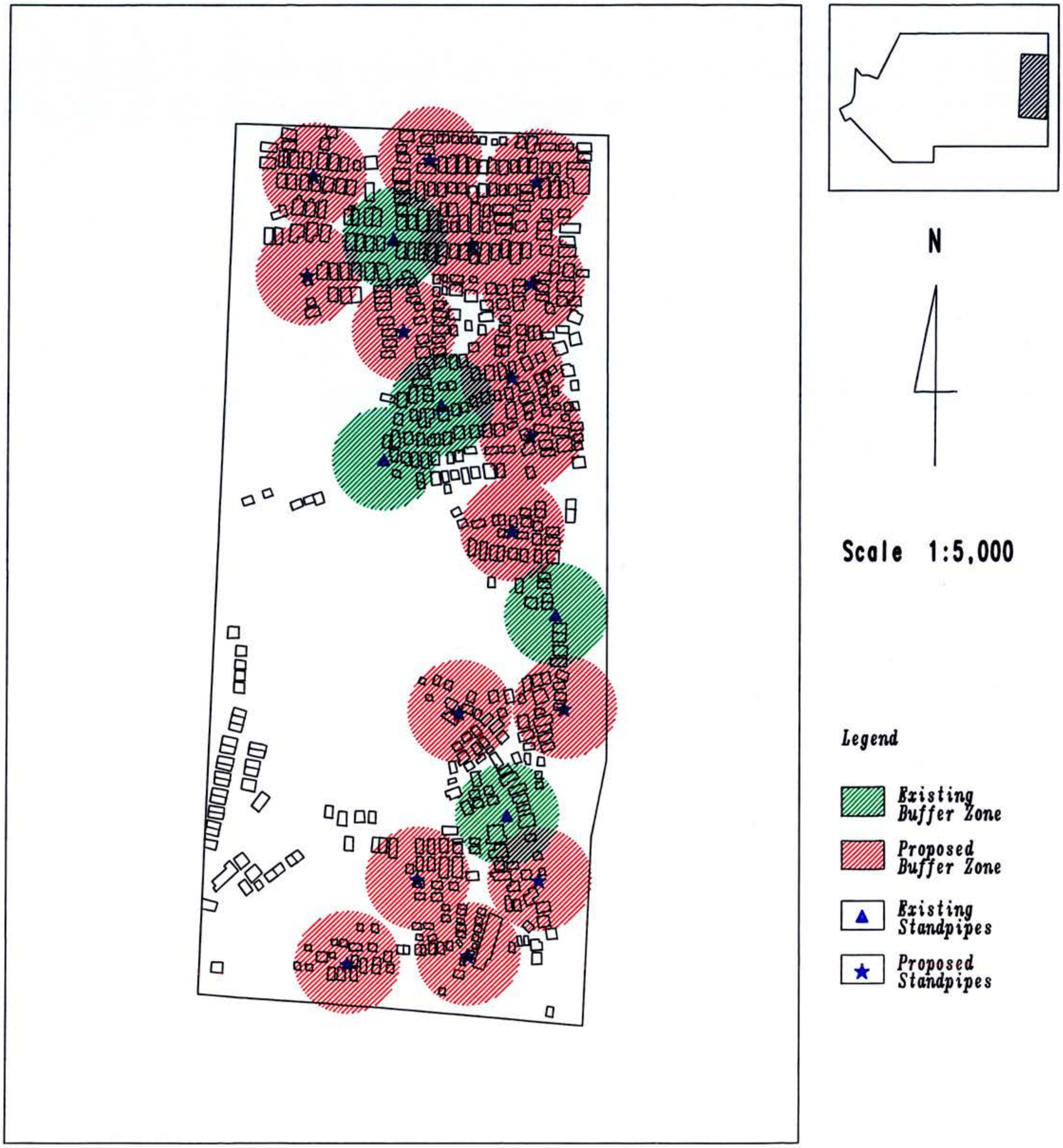
Interactive digitizing of road layouts allows the planner to design and evaluate the alternative scenarios and consequences of the design. Since it can be done repeatedly in a relatively rapid manner, the planner, decision maker and the squatters will therefore have the opportunity to choose the best alternative, or modify and create other alternatives. The same procedure can also be applied to design the layout for electricity supply lines or water pipelines.

Interactive editing can also be used to add points to a coverage. This is an important facility for a squatter upgrading programme as it can facilitate the locating of water standpipes and public telephones. As regards water supply, it has been stated in Chapter 6 that the provision of water standpipes in the Jinjang/Kepong squatter area is still inadequate. It is suggested that one standpipe should serve an area within 150 feet(3). Based on a 150 feet BUFFER, the existing standpipes can only serve 23 percent of the houses in the area identified for upgrading. To improve the situation, more water

JINJANG/KEPONG SQUATTER SETTLEMENT

Figure 9.15

ACCESSIBILITY TO PUBLIC STANDPIPES



Compiled by Ahris Yaakup on ARC/INFO, July 1990

standpipes will have to be added to the area. Water standpipes, represented by points, can be added to the point coverage using the ARCEDIT module. A BUFFER can be generated from these points to determine the accessibility. The operation can be performed by successive approximation, so as to find the best location which can maximise the accessibility to the water standpipes. Using this method, the location of 16 standpipes, to be added to the area can be suggested (Figure 9.15). Based on a 150 feet BUFFER, the additional standpipes can serve 76% of the houses in the area (Table 9.5). Using interactive editing, it is also possible to change the location as well as the number of standpipes.

Table 9.5 : Accessibility to Public Standpipes

	No of standpipes	Accessibility (based on 50 yards zone)					
		Houses		Family		Population	
		No	%	No	%	No	%
Existing standpipes	5	122	23	138	24	731	22
Addtional standpipes	16	406	76	440	75	2450	75

* % of the total number in upgrading area
Souce: Jinjang/Kepong Squatter GIS, 1990

It can be seen that a user interface as well as an interactive editing module in the GIS will enable users to communicate effectively with the database. A digital Jinjang/Kepong database provides the necessary spatial framework within which the contents of the planning database can be cross referenced and analysed.

9.6 Conclusions

In the early years of GIS, the vast majority of GIS applications were focused on individual projects and the solution to a particular problem. As DBMS software became available for managing large databases and as GIS "toolboxes" came on the scene, the emphasis has changed, so that now the vast majority of GIS users are interested in creating an integrated database for continuing use.

With DBMS tools it has become easier for the user to query the database using a simple set of commands and report writing functionality. These tools are a powerful means of allowing GIS users to create tailored application software. This puts power directly into the hands of users, making them to a considerable degree independent of technical programmers.

GIS software systems have, therefore, finally achieved the level of sophistication necessary for integrating and presenting large amounts of information in a form recognisable to non-expert computer users. System design increasingly reflects the need to bring the principles and practises of information technology within the reach of the computer illiterate. The development of powerful, flexible, yet easy-to-use macro languages and sophisticated user interfacing facilities has ensured that a knowledge of lower level programming languages is no longer required to create new applications.

Using an interactive approach to squatter planning potentially costs less for a comparable or better result than can be achieved through traditional methods. These traditional methods involved a substantial amount of plan making. The resulting maps had to be supported by manually calculated statistics. These operations were time-consuming and error prone. As a result, the number of alternatives that could be examined was very limited. Also, decision-makers, who would be presented with the hard copies of these alternatives, would generally be given no clear perception of the consequences of the different solutions. The interactive squatter planning system has demonstrated that a user interface can facilititate dynamic data manipulation and query, where the decision-maker can view the outcomes of alternative scenarios, by changing the relevant parameters in an interactive fashion. A better decision can therefore be achieved.

Notes

1 This is the mimimum standard for low-cost housing in Malaysia as proposed by Hai, T.S., (1976) 'Standards for Housing and Infrastructure in Human Settlements in Malaysia', Proceedings of the Conference on Human Settlements for the Rakyat in the Lower Income Group, Kuala Lumpur.

2 The cost is calculated based on the current costing of road improvement in village area of the Public Works Department, Malaysia. Also compare methods used in Miah, M.A.Q. and Weber, K.E., (1990) Feasible Slum Upgrading for Dhaka', Habitat INTL., Vol.14, No.1, pp. 145-160.

3 There is no standard for the provision of standpipes in Malaysia. However, the average walking distance to standpipes, observed in village areas in Malaysia is 150 feet.

CHAPTER 10

CONCLUSIONS AND DISCUSSION

10.1 Introduction

Effective urban and regional planning depends heavily upon the efficient integration of many environmental and socio-economic variables. Yet the problems of storage, retrieval, manipulation, and analysis of vast quantities of spatial and attribute data were, until recently, a major obstacle. The emergence of GIS software systems in the early 1980s offered a solution to this problem by providing tools for handling and analysing both spatial and attribute data. Most of the earlier systems, because of the demands of GIS on expensive data storage and computational resources, were operational only on large mainframe computing installations, that tended to be financially beyond the reach of most government agencies in the developing countries.

Today, there have been an enormous improvements in the price and performance of hardware and the functionality of software packages, such that a very wide range of specific demands for the management, analysis, and presentation of geographic data can now be met in a cost-effective manner. A direct consequence of these new opportunities has been the rapid growth in the number of users developing the urban and regional planning applications.

The application of GIS will in future influence the existing structure of planning organisations and the practice of planning in developing countries. As such, a critical evaluation of GIS applications should be given priority before adopting such a system. Success or failure in the adoption of GIS depends on a variety of human, organisational and technical factors.

This research has to some considerable extent explored the use of GIS in a specific project, namely squatter planning and monitoring, and examined the potential of GIS in other aspects of planning and management in developing countries. These studies were carried out within the context of the typical planning problems confronting a developing country.

Against this background, this final chapter:

1 considers the relevance of GIS for planning purposes;
2 evaluates the application of GIS for squatter planning and monitoring;
3 reviews the resultant implications for urban planning in Malaysia.

10.2 Urban Planning Problems and the Need for GIS

The nature of rapid urbanisation in most developing countries underlines the need for effectiveness in the urban management and decision-making process. Like other developing countries, the problems facing Malaysia are virtually insurmountable with respect to the vicious spiral of urban squalor, growth, congestion, and poverty, which in turn are fuelled by rural migration and resource exhaustion.

Physical planning in Malaysia must contend with many conflicting goals and circumstances. A desire to provide an amenable and efficient urban environment conflicts with the need to conserve resources which may not be needed at once. The needs of production and living often come into conflict with each other, partly through competition for scarce resources. Provision for the future will require a degree of foresight which is difficult to achieve in a rapidly changing and uncertain environment.

At local level, the projection of growth is often faced with difficulties. The most serious difficulty is that of grasping the implications of exponential growth in either its quantitative or its qualitative aspects. This means that planners are often surprised by the rate of growth in demand for facilities. A second problem is the genuine uncertainty surrounding development patterns, which is exacerbated when projections are brought down to local level. This has been made harder by the difficulty of understanding the nature of the development processes, because many of their characteristics are new, and the data sources which might support further research on them are difficult to find.

In an era of increasing urban problems, the planning authority therefore must increase their effectiveness by developing innovative ideas in carrying out their functions. The urban system can no longer be treated in terms of simple land use and traffic concepts. The planner's conception of the urban system must extend to include a host of social, political and economic variables. The mixture of problems which must all be resolved together, creates a situation in which many alternative must be tried, combined, improved and tested by analysis, by experiment, and by public discussion.

The information system therefore must expand correspondingly if anything like effective understanding and control is to be achieved. An information system is part of the mechanism for reducing uncertainty in the knowledge and understanding of the environment. The development of GIS provides a tool which can contribute to a much clearer understanding of real planning problems as well as prescriptive planning scenarios to enhance the quality of urban planning and management.

This study has shown that GIS can greatly facilitate the task of plotting, aggregating and modelling different geo-referenced data sets. It has allowed analysis of a wide range of data sets in new ways and has highlighted relationships which might otherwise have been overlooked. It gives planners more accurate and faster methods of spatial planning analysis and most importantly it allows the modelling of future development scenarios in an interactive manner.

Since the early 1980's, there have been major breakthroughs in the cost, speed and data storage capacity of computer hardware and software. With computer memory costs still dropping, with the emergence of powerful portable machines, and with the possibility of massive increased network bandwidths, enabling larger and larger segment of society to 'connect up', the prospects for new types of computer use in problem solving and policy domains, such as planning and design, have never been more promising (Yeh and Batty, 1990). These trends in the development of computer technology have indeed benefitted developing countries. Harris (1989, p. 372) succinctly stated that,

> 'Computer are becomming smaller, lighter, more rugged, more reliable, and more self-contained. They virtually do not require maintenance. Even in the exacting environment in the Third World, we should expect that within a few years micro computers could be used anywhere'.

Although microcomputers represent a fairly advanced technology, their low cost and relative ease of use make them a highly appropriate technology for rich and poor countries alike. In the words of the Executive Director of Habitat (1985);

> 'The use of inexpensive but sophisticated data management systems is of particular importance in developing countries, since it can facilitate timely information flow in situations where extensive technological and financial investments are not possible.'

This continuing trend in computer technology has the potential to be harnessed for local authority use i.e. in the setting up of municipal information systems. The possibility of establishing urban GIS as part of the municipal information system for Kuala Lumpur has also been discussed in Chapter 3. A detailed study of the design concepts for such a GIS has been presented and a pilot implementation of the system for Jinjang/Kepong squatter GIS has shown to a considerable extent the effectiveness of GIS in squatter planning and monitoring and a number of lessons can be drawn from this.

10.3 Experience with GIS Implementation: Assessment of the Jinjang/Kepong Case Study

In this study, a GIS approach has been employed to tackle the problems of the Jinjang/Kepong squatter settlement. The study began by building the database for the Jinjang/Kepong squatter settlement. The database includes a detailed inventory of the squatters as well as the settlement. In that respect, the combination of digital mapping and database management allows planners to examine the existing scenarios incorporating the physical and socio-economic characteristics of the area. The study revealed that the living condition of the squatters was quite favourable in comparison to squatters settlements in other cities of South-East Asia. However, the haphazard manner in which the buildings were laid out has given rise to uneconomic use of land. The current pressure of urban development and increased demand for housing require a detailed planning programme to be carried out for the area.

The use of the Jinjang/Kepong squatter GIS has provided opportunities to evaluate the broad development proposals by the local authority in terms of their physical impact and the socio-economic implications for the area. It can be clearly concluded that the proposed land use change to the area will involve a major resettlement programme. In the past, this problem was addressed by providing high rise low-cost housing. Such housing was not popular among the squatters, mainly because they were located far from the main sources of employment. The cost of houses was generally found to be beyond the reach of the poor. The design of high rise flats was also not favourable. The inappropriate nature of the proposed programme was felt to be partially the result of the lack of information on the real needs of the squatters. For instance, the present study clearly indicates that a large proportion of the squatters affected by the proposal have their work place near the area and most are in the low income bracket. In formulating the solution, this factor needs to be taken into consideration.

GIS has proved to be an invaluable tool for evaluation alternative solutions to squatter problems. In this study, the squatter GIS has been extensively interrogated to generate several alternative solutions to these problems. Various scenarios which take into account the socio-economic characteristics of the squatters, the constraints of physical layout, availability of land and land suitability for different kinds of development have been generated. To determine the economic efficiency of each alternative, cost-benefit analyses have been incorporated into the evaluation process. Having prepared the evaluation model, the operation was accomplished within a short time frame by using database management techniques and computer mapping of the results. In this way, the resulting scenarios, which incorporate the cost-benefit analyses, can be evaluated and modified rapidly to suit the requirements of the squatter programme.

In a planning agency, information users range from professionals who prepare alternative plans and policies to decision-makers who decide on policies and the final plans. For people who prepare policy options, the problems of complex GIS command sequences and the difficulty of combining information from different applications are especially important. Facility in the use systems is of particular importance to decision-makers. This type of user is concerned with being able to weight or evaluate policies. This factor should be taken into account in developing a user interface. This study has demonstrated that the requirements of this group can be reasonably accommodated. The development of powerful, flexible, yet easy-to-use programming languages and sophisticated screen management facilities has ensured that a user interface enables the decision-maker to view the outcome of alternative solutions by changing parameters in a fully interactive manner.

To summarise, the benefits of using GIS for squatter planning have been shown to be:

1) The ability to develop and test alternative development models which form the basis for settlement improvement;
2) The establishment of a database can be readily updated as required for later evaluation and planning;
3) Rapid estimation of the consequences of suggested improvements to planning scenarios, in terms of household relocation, and facility accessibility.

4) more insight is obtained into the process of squatter settlement growth which can be of value in the

planning and control of new housing areas;

5) more flexibility is available for the process of evaluating choices using an interactive approach.

Most of these benefits can only be realised with an extensive database. It is at the stage of GIS database creation that the planner in a developing country will face the crucial problems of implementing a GIS. While the Jinjang/Kepong squatter GIS is now operational, there are several issues that arose during the study from which lessons can be learned.

10.4 Issues and Problems in the Application of GIS to Planning in Malaysia

Several issues can be identified in using GIS for town planning in Malaysia. These include the problems of database creation, organisational issues and user requirements.

10.4.1 Creating and Maintaining a Database

The statutory requirements of the Malaysian Town and Country Planning Act 1976, mean that in order to prepare structure plans, local planning authorities need the backing of a much more comprehensive information system than previously envisaged. This is a fundamental requirement, because the Act embodies the essential principles of viewing cities and regions as complex systems in their own right. Not only must the local planning authority examine all the components of the urban system as laid down in the Act, but it must maintain a continuous review and monitor changes as well. This latter requirement implies the need for a continual updating and amendment of the database.

The major obstacle to GIS implementation in the planning context remains the very large volumes of both cartographic and attribute data that have to be converted into machine readable form. In addressing the problem of squatters, planning requirements further presuppose reasonably accurate maps showing dwelling units and land parcels in each settlement, as well as the environmental characteristics of the settlement. Lack of appropriate and up-to-date information of this type is felt to be one of the main constraints on effective application of GIS in this type of study.

Creation of the database is a difficult and costly undertaking if a suitably accurate database is to developed from diverse error prone source materials. It is a task that commonly represents 75% or more of the total cost of implementing a GIS (Aronoff, 1989). Once the database has been developed, there is also the substantial on-going maintenance cost to keep the database current.

When the present GIS was implemented virtually all of the data to be input had to be specially converted into digital form and structured in the format specific to the system. In more developed countries, standard digital geographic data sets have recently become more widely available (Aronoff, 1989). This however is not true in most developing countries.

In Malaysia, like other developing countries, several problems complicate the data situation considerably. Fewer data sets are collected, the quality of the data is much lower than developed countries, and the data sets are incomplete, especially in parts of the informal sector like the Jinjang/Kepong squatter settlement. This informal sector is by definition not properly monitored through the normal administrative procedures.

The rapid growth of Kuala Lumpur, resulting in much unplanned development, makes it difficult even to get reliable estimates on actual population and its geographic distribution. A census approach may lead to under-registration because of fears on the part of informal sector enterprises that authorities may use the information against them.

In the case of the City Hall in Kuala Lumpur, planning officers have to settle for inaccurate and outdated conventional data from various sources. They have limited data collection capacity, particularly for existing land use. Although the base map for Kuala Lumpur was available at scale larger than 1:10,000, it was ten or more years out of date, making it of limited use because of the high rates of change in many part of the city, both through informal sector activities and by the activities of real estate developers. Even an efficient low-cost source such as regular air photography is, in practice, often not available, frequently because of outdated military security concepts that make clearance difficult to obtain. Even for public use, a large scale (i.e 1:1,250 scale) base map is considered a restricted and confidential document.

For specific urban projects, field survey methods (e.g. observation and interviews) are commonly used for data collection. Their major advantage is the amount of detailed data that can be obtained. On the other hand, there are many serious restrictions: the inventory takes a substantial amount of time (during the inventory the area goes on changing), data may not be collected for the area beyond the already densely built up part of the city and the processing of the data is also time consuming.

If the GIS were to be used in combination with traditional data collection methods (field-surveys), the following constraints in relation to spatial referencing would also apply:

1) normally the survey focusses mainly on the attribute data (demographic and socio-economic data) and less on the geographical data;
2) the attributes are often treated as aggregated statistics and are only known for large geographical areas (e.g. number of people per neighbourhood);
3) When the geographical aspects of the objects (i.e individual buildings) also have to be included in the field-surveys, the time and costs involved increase significantly (land survey methods have to be used if large scale maps are not available).

To obtain the data needed for spatial planning within a short time period for a large area, a quicker method is needed. Yet, it has been shown that with approximate techniques and particularly with effective use of aerial photographs, it is still possible to create data sets which facilitate the carrying out of planning tasks. When used intelligently in combination with approximate data from such sources as regular airphoto coverage, GIS may considerably expand the analytical power available for policy preparation. Also, processing with GIS is likely to reveal major data inconsistencies, based on previous poor data capture procedures or absence of quality control. To enable data sharing and a more conducive environment for GIS applications, the various agencies involved in planning should agree on data formats and data capture procedures.

It may be possible to work even without a comprehensive database. Many theorists, (Braybrooke and Lindbloom, 1963; Faludi, 1973; Dror, 1983) have argued that we need to learn to plan under uncertainty and have developed strategies and techniques for planning with incomplete information. In using GIS, the real importance lies in the use of the database, to reduce the level of uncertainty in decision-making.

The problem of lack of appropriate data, implies a need not only for comprehensive survey and map making but also establishment of procedures for maintenance of collected data and maps. Planners too often will collect data to tackle specific problem and discard them when they have served the purpose. If the same problem arises again, the whole process of collecting data is once again repeated. Some form of procedure therefore is needed whereby the relevant data is maintained and regularly updated.

The GIS approach can make a major contribution here, as once in GIS form the data can easily be preserved for future use and linked to new data, if properly spatially referenced. A GIS approach will certainly improve data processing capacity, but the availability of data, of the right quality and in an appropriate format are prerequisites for successful implementation.

If GIS systems for urban planning are to be sustainable and really effective, they should form part of a wider local authority information system concept. A section responsible for developing and updating the different data bases should be set up. It would serve as a source of information to cater for other sections responsible for strategic and local planning, development control and enforcement. Eventually, the local authority information system may take the technical form of a multinode networked environment. This would enhance computer awareness among the staff within departments as well as among the decision-makers. However, there is a need for organisational stability to implement such systems which is not always the case in Malaysia.

10.4.2 Organisational Issues

One of the biggest challenges in the development and operation of municipal GIS is the adaptation of the organisation to the new technology. This is not to say that the organisation should be technology driven, but that some new organisational structures and operations may be required to take fullest advantage of the benefits that GIS can offer. However, changes in public organisations is not easily accomplished. This is due to the lack of trained personnel, finance and political considerations.

Well trained and dedicated personnel to operate GIS systems are not always available in a developing country like Malaysia. If they are there will be the problem of keeping competent and experienced officers throughout the project. The chance of losing competent and experienced personnel is great because of transfer or as a result of promotion or resignation (Lee, 1984). A replacement may not understand the rationale of a certain system and will take time to learn.

In a country experiencing rapid urbanisation, as soon as the GIS database is operational, it is prudent to ensure that up-dating work is begun as soon as possible. There is perhaps a need for a section in the local authority to maintain the database (McLoughlin, 1973). Another related issue is that of finance for the setting up and maintenance of the GIS. It requires a strong financial support from local authority to implement the system as well as manpower, an appropriate operating environment, office space, suitable institutional practices and the necessary political will (Drummond and Stefanovic, 1986).

There is a concept prevalent in developing countries that GIS should be used for greater coordination among agencies and different units, and that it is good to institute uniform practices in information management (Aronoff, 1989). It is indeed economical and operationally feasible for the systems to address the wider needs of government agencies and the community as a whole. If the implementation of a large municipal digital map base is to be successful, a greater coordination among the various government departments is a prerequisite for the implemention of such general-purpose systems that serve several agencies in the municipality.

10.4.3 Types of User and the Range of Requirements

Since GIS needs vary among departments, a GIS implemented by one department may not serve the needs of the others. In local authority applications, engineering and assessment functions require more positional precision than do planning functions, for example. A system developed with greater precision will require more money and time, but will also serve the needs of the users requiring less precision. Systems developed with less precision may be quicker and less expensive to implement, but will not serve the needs of users requiring higher precision.

In the planning environment, Scholten and Padding (1990) point out that the user demand on GIS varies according to the needs for spatial information. In the planning process, two main groups of users can be distinguished.

The first group are the planners involved with policy preparation in a specific sector of spatial planning. At present, the application of GIS is largely limited to this group. Many applications only involve the reproduction of data on maps. In the plan-making process, however, one wants to make use of all available analytical methods. Advanced use of GIS is only possible with the help of specialist staff.

The other main group are the policy decision-makers who are concerned with the weighting of policies on the basis of supplied scenarios. The involved citizen is also classified under this group. Up to now, the application of computer automation has been very limited for these users. Policy decision-makers and the public at large have generally little knowledge of computers. For these groups, user-friendly interfacing is of paramount importance.

10.5 Considerations in the Effective Use of GIS for Urban Planning

The main objectives of a planning agency are to stimulate and guide social and economic development, utilising the various tools open to it. In the past, planning agencies have been geared to physical planning. More recently, emphasis has shifted to social and economic planning. These two sets of objectives of planning agencies have led to two different views of the roles of the agencies.

The philosophy of planning has often been thought of as "top-down", although occasionally there is increasing emphasis on "bottom-up". In the top-down view, the role of planning is seen as developing a comprehensive plan and adopting it for implementation. The development process involves collection and analysis of large quantities of data, in an attempt to be comprehensive. The time frame of such planning is typically "long-range" and the plan can often be translated into five-year and annual implementation programmes.

There is an emerging view that the most effective approach for a planning organisation is to see its role as "catalyst" or "bottom-up" in operation. In this role, the organisation focuses on stimulating actions by others to move in desired directions.

In the light of these alternative roles of planning, Manheim (1987) suggested, there should be two main objectives of for GIS in planning agencies in developing countries:

1) to provide support to traditional planning activities, oriented to "top-down" planning;
2) to provide support for the role of the agencies as a catalyst to social and economic development by exploiting the power of information technologies.

Meeting such objectives is not quite so straightforward. In Malaysia both the 'top-down' and 'bottom-up approach are being used, the first approach is still in the design stage, while the second is at least partly operational. The 'top-down' approach formed the basis for the design of a comprehensive image-based database being created by the Ministry of Land and Regional Development. On the other hand, there has been a pragmatic 'bottom-up' strategy of creating adhoc information systems. For example, the character-based database for city planning which Kuala Lumpur City Hall is now working on (Ali, 1989). Several separate agencies are considering creating their own GIS, including the national remote sensing centre, the forestry, and the agriculture departments. However, there are no links planned between the image-based system and other efforts such as the Kuala Lumpur city database (Kadir, 1989).

These examples suggest the importance of taking an incremental approach to GIS design which reflects the dynamics of the agency concerned. In the words of Cartwright, (1987 p.193),

> 'It is better to have a modest system in use than an elaborate one that remains 'on the drawing board' going through a never-ending process of refinement'.

To develop such system, the need of the local conditions should be considered. Drawing from case studies in India, Sri Lanka and Mexico in developing information systems, Cartwright (1987) concludes that information systems;

1) should complement the existing resources and skills available to planners and be designed to accommodate changes in their environment;

2) should be integrated with other data sources such as other systems, databases and maps;

3) must allow data to be manipulated (e.g. aggregated, analysed, projected, modelled and mapped) in a flexible way through user-friendly interfaces;

4) will have organisational consequences which affect both the agency using the system and their relations with other agencies which are involved either directly or indirectly in the planning process.

The setting up of a GIS in a developing country involves a large investment. However, it is doubtful whether the system can function satisfactorily and whether it can contribute to national development. The importance of having appropriate policy support for computer development cannot be underestimated. All case studies highlight the need for clear leadership and personal motivation. Also, great emphasis must be placed on adaptive learning so the system can evolve in response to changing circumstances.

Thus, for effective utilisation of computers in urban planning agencies in developing countries Masser and Campbell (1989) contend that three necessary and generally sufficient conditions have to be met. These are;

1) The existence of an overall information management strategy based on the needs of users in the planning agency and the resources that are at its disposal;

2) The personal commitment of individuals at all levels

in the organisation with respect to overall leadership, general awareness and technical capabilities;

3) Organisational stability with respect to personnel, administrative structures and environmental considerations.

It must be recognised that only a small minority of agencies in these countries are likely to be able to satisfy these condition in full and that the vast majority will fall short in one or more respects.

The main strategy underlying the whole discussion about conditions for effective utilisation is the use of an incremental approach to system design. It may begin with a simple forms-driven data system and then move through thematic mapping and a single purpose GIS to a comprehensive, multipurpose GIS. This step-by-step strategy provides a valuable opportunity for accumulating the practical experience needed for increasingly more ambitious efforts. More importantly, it allows the practical value of the system to be demonstrated early and in turn helps to ensure the political and management support needed to continue the long-term development effort by which a larger system can be developed.

The strategy of "one step at a time " emphasises the importance of learning by practical experience, in a field which tends to be dominated by technological innovation. The case study documented in this thesis strongly suggests that a GIS can be a very useful tool for carrying out a comprehensive and interdisciplinary analysis of squatter phenomena. The Jinjang/Kepong squatter GIS could serve as a test design and pilot project which could be used to build up experience and provide the overall awareness of new technology in a local authority like Kuala Lumpur.

It should however be realised that a comprehensive system for planning use is hard to implement even by taking an incremental approach. Especially in a developing country, it is difficult to negotiate differences in data definitions and formats among the various governments. One commonly encountered problem in map overlay analysis occurs when roads, coastlines, and boundaries from different sources do not match. In this regard, the Survey Department should develop standardised base maps to serve as the integrator and coordinator of the system. This will encourage planning departments or other agencies to integrate their textual data into the system.

Training/education is another essential component to ensure the smooth transfer of GIS technology. Sophisticated GIS requires trained and experienced technicians to operate and maintain the system, and more importantly, sophisticated planners, analysts, and managers to determine what type of information should be collected and to interpret and use the information that these system produces. At present the planning process in developing countries is best served by concentrating on available GIS toolkits. Planners should focus their attention on the application of the systems and let the information specialists develop the system themselves further by giving suggestions as to what is needed. What is also important now, is to develop user interfaces which will enable other non-computer experts to be involved in planning using the system.

Higher learning institutions which run planning courses, should promote the use of GIS for planning purposes. They should be geared towards more research in GIS applications and organise courses and conduct joint research and projects with local authorities in the application of GIS to urban planning.

10.6 Final Conclusions

With the continued development of computer technology there is a major opportunity for developing countries to used it to manage the allocation of scarce resources in a rapidly changing environment. The quality of spatial planning and decision-making can be upgraded when available and valid data are handled in an advanced manner with the aid of computers. GIS can support spatial planning and decision-making because it offers relatively quick responses on analytical questions and monitoring issues. Some of the important functions include the ability to retrieve information rapidly and efficiently, to model different future scenarios and to evaluate alternative solutions generated by various modelling procedures.

However, the transfer of technology to the less developed world will be difficult because of the non conducive environment, in terms of human, organisational, and technical factors. The implementation of GIS involves far more than hardware and software decisions. Effective implementation rests on a thorough and systematic evaluation encompassing planning, operational, organisational, institutional, personnel, financial, and technical aspects. GIS is still a developing area. To optimise GIS use, more research and attention need to be directed towards organisational and institutional issues, technology transfer, appropriate systems for developing countries and technical aspects of GIS hardware and software. To avoid the high cost of investment required to install a large system, it is suggested that a developing country should start with small scale, manageable projects before deciding to have a more comprehensive system at national level. As an important new component of planning methodology, GIS will move forward most rapidly in those areas where the organisational environment adapts in a positive manner to benefit from the opportunities it offers.

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APPENDIX A

PENINSULAR MALAYSIA : **Rural - Urban Migration 1957 - 1970**

Settlement Size	1957 pop.	1970 pop.	% change vis-a-vis total	% change X 1957 pop.	In	Out
P. Malaysia	6,278,758	8,801,399	0=140.17	0	-	-
Rural (-5,000)	4,323,871	5,796,259	- 6.12	255,000	-	265,000
Urban (5,000+)	1,954,887	3,005,140	+ 13.55	265,000	265,000	-
5 - 10,000	200,681	380,772	- 3.98	11,000	-	11,000 (16%)
10 - 20,000	196,635	225,897	- 24.76	49,000	-	49,000 (68%)
20 - 30,000	147,030	211,470	+ 4.19	6,000	6,000 (9%)	-
30 - 40,000	184,666	257,307	- 0.31	1,000	-	1,000 (1%)
40 - 50,000	90,710	115,855	- 11.92	11,000	-	11,000 (11%)
50 - 100,000	325,412	481,656	+ 8.37	27,000	27,000 (38%)	-
100,000 +	733,533	1,062,069	+ 5.14	38,000	38,000 (53%)	-
Total 5 - 100,000 + above	1,958,667	2,735,034	0=139.64	-	-	-

Source : Pahang Tenggara Master Planning Study : Sociology and Migration, 1974

APPENDIX B

The Goals of Kuala Lumpur Structure Plan

1 to promote and regulate development to facilitate the implementation of the New Economic Policy;

2 to maintain and enhance the role of Kuala Lumpur as the seat of the Federal Government;

3 to facilitate the establishment of Kuala Lumpur as the centre for the promotion of the national culture and religious and for the projection of desired image of Malaysia;

4 to maintain and enhance the role of Kuala Lumpur as the commercial and financial centre of the nation and to encourage development towards the establishment of Kuala Lumpur as the centre for regional and international activities;

5 to maintain and enhance the city economy and ensure that economically active residents of all community groups are given opportunities for gainful employment;

6 to facilitate and encourage the provision of adequate housing at acceptable standard for all income levels;

7 to provide adequate amenities and facilities for the social and physicological well-being of the city's population taking into cognizance the need to socially integrate the various community groups;

8 to achive the best physical structure and arrangement for Kuala Lumpur and to be supported by an efficient transportation system;

9 to secure the most feasible environmental standard through a judicious balance between development, ecology and national heritage;

10 to ensure that future development, redevelopment and growth of the city is adaptable to changing circumstances in the long term.

APPENDIX C

QUESTIONNAIRE

Socio-economic Survey of Jinjang/Kepong
Squatter Settlement

Name of Enumerator : ______________________

Date of Interview : ______________________

Area Code : ______________________

Building Code : ______________________

Name of Respondent : ______________________

Address : ______________________

A. BACKGROUND INFORMATION

1. Occupation of head of family

1	Professional	☐
2	Administrative	☐
3	Clerical	☐
4	Sales	☐
5	Agricultural/Fisheries	☐
6	Production	☐
7	Defence	☐
8	Transport	☐
9	Services/Others	☐
10	No Occupation	☐

2. Income ($)

1	None	☐
2	99 or less	☐
3	100 - 199	☐
4	200 - 299	☐
5	300 - 399	☐
6	400 - 499	☐
7	500 - 599	☐
8	600 - 699	☐
9	700 - 799	☐
10	800 - 899	☐
11	900 - 999	☐
12	1000 or more	☐

3. Distance to Work Place (Miles)

1 2 or less
2 3 - 4
3 5 - 6
4 7 - 8
5 9 - 10
6 10 or more

4. Mode of Transport

1 Walking
2 Bus
3 Motorcycling
4 Bicycle
5 Car
6 Others
7 Does not go to work

B. INFORMATION ON PRESENT HOUSE

1. Duration of Stay

1 Less than 5 years
2 5 - 10 years
3 11 - 15 years
4 More than 15 years

2. Reason for Staying

1 To own a house
2 Proximity to work place
3 Availability of land
4 Cheap rent
5 Staying with relatives
6 Having large compound
7 Land availability for gardening
8 Others

3. Number of family in the house

1 One
2 Two
3 Three or more

4. Number of people/s in the house

C. INFORMATION ON BUILDING

1. Building Use

1 House
2 Industry/workshop
3 Commercial
4 Public building

2. Building Type

1 Single
2 Semi-detached
3 Row (3 - 4)
4 Row (More than 4)

3. Number of bedroom/s in the house

1 One
2 Two
3 Three
4 Four or more
5 No room

4. Building Condition

1 New
2 Moderate
3 Old
4 Dilapidated

5. Age of Building (years)

1 Less than 5
2 6 - 10
3 11 - 15
4 16 - 20
5 21 - 25
6 26 - 30
7 More than 31

6 Basic Facilities in the Building

1 Electricity
2 Piped-water
3 Telephone
4 Toilet

D. FUTURE HOUSING PREFERENCE

1. Type of house

1 Detached
2 Semi-detached
3 Terrace
4 Cluster
5 Flat (1 - 5 storeys)
6 Flat (6 - 10 storeys)
7 No answer

2. Number of rooms

3. Preferred Price ($)

1 5000 or less
2 5001 - 10,000
3 10,001 - 15,000
4 15,001 - 20,000
5 20,001 - 30,000
6 30,001 - 35,000
7 35,001 or more
8 No answer

4. Preferred Location

1 Within 3 miles of existing settlement
2 Outside 3 miles of existing settlement
3 No answer

5. Method of housing development

1 Ready made
2 Half ready/core unit
3 Site (land)
4 No answer

APPENDIX D

DATAFILE NAME: UP2BL.PAT
22 ITEMS: STARTING IN POSITION 1 11/27/1991

COL	ITEM NAME	WIDTH	OPUT	TYPE	N.DEC	ALTERNATE NAME
1	AREA	4	12	F	3	
2	PERIMETER	4	12	F	3	
9	UP2BL£	4	5	B	0	
13	UP2BL-ID	4	5	B	0	
17	BLDNO	5	6	I	0	BUILDING_NO
22	BUS	2	3	I	-	BUILDING_USE
24	CON	2	3	I	-	BUILD_CONDITION
26	RM	2	3	I	-	NO_OF_ROOM
28	POP	2	3	I	-	HOUSE_OCCUPANCY
30	FM	2	3	I	-	MULTI_FAMILY_OCC
32	DS	2	3	I	-	DURATION_STAY
34	RE	2	3	I	-	REASON_FOR_STAY
36	OC	2	3	I	-	OCCUPATION
38	IN	2	3	I	-	MONTLY_INCOME
40	DW	2	3	I	-	WORK_DISTANCE
42	MT	2	3	I	-	MODE_TRANSPORT
44	HP	2	3	I	-	HOUSE_PREFERENCE
46	RP	2	3	I	-	ROOM_PREFERENCE
48	PP	2	3	I	-	PRICE_PREFERENCE
50	LP	2	3	I	-	LOCATION_PREFERE
52	DBU	2	3	I	-	DETAILED_B_USE
54	MP	2	3	I	-	METHOD_PREFERENC

APPENDIX E

JINJANG PLANNING UNIT

Jinjang Planning unit lies to the northwest part of the Federal Territory. It is bounded by Edinburgh Planning Unit in the South and Jalan Kuching/Ipoh in the east. It covers a total area approximately 2121 hectares or 8.8% of the total Federal Territory's land area. The existing and committed land uses are shown below:

Jinjang Planning Unit: Existing Land Use, 1986

	Land Use	Area (Hectare)	%
1	Housing	499.0	23.6
2	Commercial	47.4	2.2
3	Industrial	166.6	5.5
4	Communities Facilities	10.9	0.5
5	Public Facilities	2.3	0.1
6	Education	39.2	1.9
7	Government Reserved	6.4	0.3
8	Recreational	16.4	0.8
9	Cemetery	6.2	0.3
10	Squatters	330.8	15.6
11	Mining and Ex-mining	672.6	31.8
12	Undeveloped Land	183.8	8.7
13	Primary Road	65.5	3.1
14	Electical Tranmission Reserved	64.7	3.0
15	Drainage Reserved	35.6	1.7
16	Railways Reserved	21.0	1.0
	Total	2118.6	100.0

Source: Jabatan Perancangan dan Kawalan Bangunan, (1988) 'Draft Jinjang Local Plan', Dewan Bandaraya Kuala Lumpur (DBKL).

The most prominent land use of the planning unit is mining and ex-mining lands which occupy 26.3% of the total land area.

The planning unit is designed to have a total population of 185,000 people and employment of 33,000 by the year 2000. In preparing the local plan, due attention is given to the followings:

1 the need to accommodate an increase in population of about 68,500 peoples;

2 the shortage of land for development purposes with only 103.3 hectares of land readily available for development. However, 557.5 hectares of mining and ex-mining land can be made available for development in the future;

3 the need to provide 21,020 dwelling units during the 1980-2000 period to cater for additional households, clear present backlog and replaced dilapidated units;

4 the existing physically depressed industrial areas need to be redeveloped and upgraded and further industrial expansion need to be limited;

5 the existing town centre of Jinjang needs to ne upgraded to a local centre which shall cater for the needs of its immediate catchment;

6 the need to provide a metropolitan park of about 52 hectares.

The goals formulated in the Kuala Lumpur structure plan formed the basic philosophy and direction of the Jinjang local plan. When tranlasted into specific objectives they read as follows:

1 to provide adequate areas for future development of dwelling units for the targeted population of the planning unit;

2 to provide adequate employment opportunities in commercial, industrial and institutional activities in the area;

3 to provide a transport network that is safe and efficient;

4 to provide adequate social and recreational facilities;

5 to formulate land use distribution which is in harmony with the environment.

APPENDIX F

(a) LUNION3.PAT

Attribute data of combined coverages (LUINIO3.PAT) used to select area for squatter development strategies and alternative housing for squatters. Selection is based on item values. Item definitions are listed below.

DATAFILE NAME: LUNION3.PAT
22 ITEMS: STARTING IN POSITION 1 11/27/1991

COL	ITEM NAME	WIDTH	OPUT	TYPE	N.DEC	ALTERNATE NAME
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	LUNION3£	4	5	B	0	
13	LUNION3-ID	4	5	B	0	
17	FLOOD	5	6	I	-	FLOODED_AREA
21	LOT_NO	5	6	I	-	PARCEL-ID
26	OWN	2	3	I	-	LAND_OWNERSHIP
28	OWND	4	5	N	2	DETAILED_OWNER
32	VAL	2	3	I	-	LAND_VALUES
34	PRLU	4	5	I	-	PROPOSE_L_USE
38	PRLUD	4	5	I	-	DETAIL_PRO_USE
42	PRLST	4	5	I	-	DEVELOPT_STATUS
46	PRLPD	4	5	I	-	DEVELOPT_PHASES
50	PRLDV	4	5	I	-	PROP_DEVELOPER
54	AREA_H	7	7	N	3	AREA_IN_HECTARE
61	LH_COST	7	7	N	3	COST_LOW-COST
68	LH_BEN	7	7	N	3	BENEFIT_LOW-COS
75	SS_COST	7	7	N	3	COST_SITE_SERVI
82	SS_BEN	7	7	N	3	BENEFIT_SIT_SER
89	UP_COST	7	7	N	3	UPGRADING_COST
96	UP_BEN	7	7	N	3	UPGRAD_BENEFIT
103	DEN	3	3	I	-	HOUSING_DENSITY

(b) ITEM VALUES

The followings are item values of the above data files used in ARC/INFO RESELECT command.

i) FLOOD.SYM - item values for flood

$RECNO	FLOOD	AREA_AFFECTED_BY_FLOOD
1	1	FLOOD PRONE AREA
2	2	NO FLOOD RISK AREA

ii) OWN.SYM - item values for land ownership

$RECNO	OWN	LAND_OWNERSHIP
1	1	PRIVATE LAND
2	2	GOVERNMENT LAND

iii) OWND.SYM - item values for detailed land ownership

$RECNO	OWND	DETAILED_LAND_OWNERSHIP
1	1.00	PRIVATE LAND
2	2.10	STATE LAND
3	2.20	GOVERNMENT INSTITUTE
4	2.30	PRIVATISATION

iv) VAL.SYM - item values for land values per square foot

$RECNO	VAL	LAND_VALUES
1	1	BELOW $1.00
2	2	$1.00 - $3.00
3	3	$3.00 - $5.00
4	4	$5.00 - $10.00

v) PRLU.SYM - item values for proposed land use

$RECNO	PRLU	PROPOSED_LAND_USE
1	2	HOUSING
2	3	COMMERCIAL
3	4	INDUSTRY
4	5	GOVERNMENT INSTITUTION
5	10	OPEN SPACE
6	11	SCHOOL
7	12	COMMUNITY FACILITIES
8	13	ROAD RESERVE

vi) PRLST.SYM - item values for status of development

$RECNO	PRLST	STATUS_OF_DEVELOPMENT
1	1	EXISTING DEVELOPMENT
2	2	APPROVED DEVELOPMENT
3	3	PROPOSED DEVELOPMENT
4	4	ROAD RESERVE

vii) PRLPD.SYM - item values for phases of development

$RECNO	PRLPD	PHASES OF DEVELOPMENT
1	1	EXISTING DEVELOPMENT
2	2	BETWEEN 1990 - 1995
3	3	BETWEEN 1195 - 2000
4	4	AFTER 2000

viii) PRLDV.SYM - item values for identified developers

$RECNO	PRLDV	IDENTIFIED_DEVELOPERS
1	1	PRIVATISATION
2	2	PRIVATE SECTOR
3	3	GOVERNMENT DEPARTMENT
4	4	NOT IDENTIFIED
5	5	CITY HALL

ix) DEN.SYM - item values for housing density per hectare

$RECNO	DEN	HOUSING_DENSITY
1	1	LESS THAN 10 HOUSES
2	2	BETWEEN 11 - 20 HOUSES
3	3	BETWEEN 21 - 30 HOUSES
4	4	MORE THAN 30 HOUSES

(c) LOGICAL EXPRESSION

The logical expressions to select area for various squatter development strategies and housing programmes are as follows: (see the above for item definitions and values)

i) SQUATTER IMPROVEMENT AREA

IF area is government owned land;
 AND land value less than $3.00 per square foot;
 AND area is not flood risk;
 AND area is not for residential use;
 AND area will not be developed within the next five years;
THEN area will suitable for improvement.

The ARC/INFO RESELECT command reads,

```
RESELECT OWN = 2 AND PRLU NE 2 AND VAL LE 2 AND
         PRLPD GE 4 AND FLOOD = 2
```

ii) SQUATTER UPGRADING AREA

IF land is owned by government;
AND land is not use for public purpose;
AND land is appropriate for housing use;
AND existing housing density is more than 30 units per hectare;
THEN area is suggested for improvement.

The ARC/INFO RESELECT command reads,

```
RESELECT OWN = 2 AND FLOOD = 2 AND PRLU = 2 AND
         VAL LE 2 AND DEN GE 4
```

iii) NO PUBLIC ACTION

IF land is privately owned;
AND land does not pose a threat to health and safety;
THEN no public action.

The ARC/INFO RESELECT command reads,

```
RESELECT OWN = 1 AND FLOOD = 2
```

iv) SITE AND SERVICES PROJECT

IF land is government owned;
AND area is appropriate for residential use
AND land is not subject to flooding;
AND land value is below $1.00 per square foot;
AND land is not needed for public purpose;
AND existing housing density is less than 10 units per hectare
THEN area is suitable for site and services project

The ARC/INFO RESELECT command reads,

```
RESELECT OWN = 2 AND PRLU = 2 AND FLOOD = 2 AND
         VAL = 1 AND DEN = 1
```

v) LOW-COST HOUSING AREA

```
IF    land is owned by the government;
 AND  land is appropriate for residential use;
 AND  land is not needed for public purpose
 AND  land value is more than $3.00 per square
        foot;
THEN  area suitable for low-cost housing project
```

The ARC/INFO RESELECT command reads,

```
RESELECT OWN = 2 AND PRLU = 2 AND VAL GT 3
```

(d) ARC/INFO RESELECT expressions for alternative proposals 3 and 4:

ALTERNATIVE 3

```
RESELECT OWN = 2 AND PRLU = 2 AND DEN LT 4
```

ALTERNATIVE 4

For Upgrading Area,

```
RESELECT OWN = 2 AND FLOOD = 2 AND PRLU = 2 AND
         VAL LE 2 AND DEN GE 3
```

For Low-cost Housing Area,

```
RESELECT OWN = 2 AND PRLU = 2 AND VAL GE 4
NSELECT
ASELECT OWN = 2 AND PRLU = 2 AND VAL GE 3 AND
        DEN LE 2
```

For Site and Services Area,

```
RESELECT OWN = 2 AND PRLU = 2 AND VAL = 1 AND
         DEN LE 1
```

APPENDIX G

DETAILED COSTING OF FORMALISED LOW-COST HOUSING PROJECT

Costing of Low-cost housing project is estimated by the author with the help of a quantity surveyor and a property valuer on Jinjang Kepong/Kepong Area. Detail break down as follows (see main text for assumption);

DEVELOPMENT COST

		$ Per Hectare
A	Land and Development Cost	
1.	Land premium @ $3.00 per hectare	322,910.28
2.	Quit rent and assessment @ $56/Unit	6,160.00
3.	Model and Sign Board	500.00
4.	Land Surveyor fee	11,187.00
5.	Valuation fee	2,833.75
6.	Plan fees	3,852.10
7.	Site Office	1,100.00
8.	Preliminary Expanses	2,833.75
9.	Land conversion fee	2,471.00
	Total	383,847.88
B	Infrastructure Cost	
1.	Site clearence	17,689.50
2.	Earthworks	74,714.85
3.	Road works	129,977.37
4.	Drainage	59,836.57
5.	Oxidation pond	24,033.32
6.	Water reticulation	29,140.06
7.	Elevated water tank	28,473.60
8.	Electrical reticulation	16,977.20
9.	Electrical substation	14,260.24
10.	Telephone reticulation	20,262.20
11.	Playground/field	10,488.58
12.	Landscaping	7,160.64
	Total	432,914.14
C	Building Cost	
	110 units @ 20,000/unit	2,200,000.00

D Administrative Cost

1.	Client's administrative cost	19,000.00
2.	Legal Fees	10,000.00
3.	Brochures and advertising	2,000.00
	Total	31,000.00

E Professional fee

Based on consortium fee of 8% of building and infrastructure cost i.e 2,632,914.10 @ .08	210,633.13
TOTAL DEVELOPMENT COST	3,228,385.20

REVENUE FROM SALE

110 @ 35,000.00	3,850,000.00

In the discussion we do not use revenue from sales of the houses and benefit of the project, instead of that we take annual rental value of the houses. The rationales are discuss in the main text.

BENEFIT

$$Bi = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

Bi = 110 @ 250 @ 12 = 330,000.00 (annual rental value)
Sv = 3,228,395.20 (Salvage value)
f = 6.5% (annual inflation for gross rent)
K = 7% (interest rate)
n = 20 years
t = the time period

COST

$$Ci = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

Co = 3,228,395.20 (initial cost)
Cm = 161,419.76 (maintenance cost i.e., 5% of development cost)
Sv = 3,228,395.00
f = 4% (annual inflation for miscellanous goods and services)
k = 7% (interest rate)
n = 20 years
t = the time period

Present Value Benefit and Cost at 7 percent Interest rate

Benefit			Cost		
Year 1	=	328,457.94	Year 1	=	156,893.97
Year 2	=	326,923.09	Year 2	=	152,495.08
Year 3	=	325,395.42	Year 3	=	148,219.51
Year 4	=	323,874.88	Year 4	=	144,063.83
Year 5	=	322,361.44	Year 5	=	140,024.65
Year 6	=	320,855.08	Year 6	=	136,098.73
Year 7	=	319,355.76	Year 7	=	132,282.88
Year 8	=	317,863.44	Year 8	=	128,574.01
Year 9	=	316,378.10	Year 9	=	124,969.14
Year 10	=	314,899.70	Year 10	=	121,465.33
Year 11	=	313,428.21	Year 11	=	118,059.76
Year 12	=	311,963.59	Year 12	=	114,749.67
Year 13	=	310,505.81	Year 13	=	111,532.39
Year 14	=	309,054.85	Year 14	=	108,405.31
Year 15	=	307,610.67	Year 15	=	105,365.91
Year 16	=	306,173.24	Year 16	=	102,411.73
Year 17	=	304,742.52	Year 17	=	99,540.37
Year 18	=	303,318.49	Year 18	=	96,749.52
Year 19	=	301,901.12	Year 19	=	94,036.92
Year 20	=	300,490.36	Year 20	=	91,400.37
+ Sv	=	834,278.62	+ Co	=	3,228,395.00
			- Sv	=	834,278.62
		7,119,832.40			4,821,455.50

NPV (B - C) = 2,298,376.90

Ratio (B/C) = 1.48

APPENDIX H

DETAILED COSTING OF SITE AND SERVICES PROJECT

Costing is estimated by author with the help of a quantity surveyor and a property valuer. Breakdown cost of site and services project provide by the City Hall.

DEVELOPMENT COST

		$ Per Hectare
A Land		
	Land Premiun @ $1.00 per feet	43,560.00
B Infrastructure Cost		
1.	Site Clearance and Earthworks	69,303.26
2.	Road works	97,482.75
3.	Drainage	44,877.42
4.	Water reticulation	21,855.00
5.	Electrical reticulation	12,732.90
6.	Telephone reticulation	10,131.10
	Total	256,382.43
C Buildings Cost		
	145 @ $ 7,500.00 / unit	1,087,500.00
	TOTAL DEVELOPMENT COST	1,387,442.43

REVENUE

Revenue of benefit of the project is obtained from annual rental value of the houses. i.e., $ 150.00 per month per unit. A detailed computation of the present value of the costs and benefits of the project at 7 percent interest rate are presented here. Refer to the main text for assumption and rationale in the computation.

BENEFIT

$$Bi = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

Bi = Benefit from annual rental value
Year 1 = 130,500.00, Year 2 = 195,750.00
and Year 3 through Year 20 = 261,000.00
Sv = 1,387,442.43
f = 6.5 % (inflation rate for gross rent)
k = 7 % interest rate
n = 20 years
t = the time period

COST

$$Ci = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

Co = 1,387,443.43 (initial development cost)
Cm = 69,372.12 (maintenance cost
i.e., 5% of development cost)
Sv = 1,387,443.43 (salvage value)
f = 4% (annual inflation rate)
k = 7% interest rate
n = 20 years period
t = the time period

Present Value Benefits and Costs at 7 percent interest rate

Benefits		Costs	
Year 1 =	129,890.19	Year 1 =	67,427.11
Year 2 =	193,924.84	Year 2 =	65,536.63
Year 3 =	257,358.19	Year 3 =	63,699.15
Year 4 =	256,155.58	Year 4 =	61,913.20
Year 5 =	254,959.60	Year 5 =	60,177.31
Year 6 =	253,767.20	Year 6 =	58,490.10
Year 7 =	252,581.37	Year 7 =	56,850.19
Year 8 =	251,401.09	Year 8 =	55,256.26
Year 9 =	250,226.31	Year 9 =	53,707.02
Year 10 =	249,057.03	Year 10 =	52,201.22
Year 11 =	247,893.21	Year 11 =	50,737.63
Year 12 =	246,734.83	Year 12 =	49,315.08
Year 13 =	245,581.86	Year 13 =	47,932.41
Year 14 =	244,434.29	Year 14 =	46,588.52
Year 15 =	243,292.07	Year 15 =	45,282.80
Year 16 =	242,155.19	Year 16 =	44,012.70
Year 17 =	241,023.63	Year 17 =	42,778.70
Year 18 =	239,897.35	Year 18 =	41,579.30
Year 19 =	238,776.33	Year 19 =	40,413.52
Year 20 =	237,660.55	Year 20 =	39,280.44
+ Sv =	358,541.48	+ Co =	1,387,442.43
		- Sv =	358,541.48
	5,135,311.30		2,072,079.70

NPV (B - C) = 3,063,231.60

Ratio (B / C) = 2.49

APPENDIX I

DETAILED COSTING OF SQUATTERS UPGRADING PROJECT

Costing of Squatter Upgrading project is estimated by the author with the help of a quantity surveyor and a property valuer. Detail breakdown of the projects cost is based on squatter upgrading project by the City Hall.

DEVELOPMENT COST

A Land	**$ per hectare**
Land premium @ 2.00 /sq feet	87,120.00
B Infrastructute Cost	
1. Public standpipes i.e., 5 @ 500.00	2,500.00
2. Road Improvement	50,000.00
3. Electrical reticulation	5,000.00
4. Water reticulation	9,000.00
5. Public phones i.e., 5 @ 300.00	1,500.00
Total	68,000.00
C Building Cost	
44 @ 7,500.00	330,000.00
TOTAL DEVELOPMENT COST	485,120.00

REVENUE

Revenue or benefit of the project is obtained from annual rental value of the houses. i.e., $120.00 per month per unit. A detailed computattion of the present value of the costs and benefits of the project at 7 percent interest rate are presented here. Refer to main text for the assumption and rationale used in the computation.

PRESENT VALUE OF BENEFIT AND COST OF SQUATTER UPGRADING PROJECT

BENEFIT

$$Bi = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

Bi = Benefit from annual rental value
i.e. Year 1 = 39,600.00, Year 2 = 59,400.00 and
Year 3 through year 20 = 79,200.00
Sv = 485,120.00 (salvage value)
f = 6.5% (annual inflation rate for gross rent)
k = 7% interest rate
n = 20 years
t = the time period

COST

$$Ci = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

Co = 485,120.00 (initial cost)
Cm = 24,254.00 (maintenance cost)
Sv = 485,120.00 (salvage value)
f = 4% (annual inflation rate for goods and services)
k = 7% interest rate
n = 20 years period
t = the time period

Present Value Benefit and Cost at 7 percent interest rate

Benefit		Cost	
Year 1 =	39,114.95	Year 1 =	23,573.98
Year 2 =	58,846.16	Year 2 =	22,913,03
Year 3 =	78,094.90	Year 3 =	22,270.61
Year 4 =	77,729.97	Year 4 =	21,646.20
Year 5 =	77,366.74	Year 5 =	21,039.29
Year 6 =	77,005.22	Year 6 =	20,449.41
Year 7 =	76,645.38	Year 7 =	19,876.06
Year 8 =	76,287.23	Year 8 =	19,318.79
Year 9 =	75,930.74	Year 9 =	18,777.14
Year 10 =	75,930.74	Year 10 =	18,250.68
Year 11 =	75,222.77	Year 11 =	17,738.98
Year 12 =	74,871.26	Year 12 =	17,241.62
Year 13 =	74,521.39	Year 13 =	16,758.21
Year 14 =	74,173.16	Year 14 =	16,288.36
Year 15 =	73,826.56	Year 15 =	15,831.67
Year 16 =	73,481.58	Year 16 =	15,387.79
Year 17 =	73,130.20	Year 17 =	14,956.36
Year 18 =	72,796.44	Year 18 =	14,537.02
Year 19 =	72,456.27	Year 19 =	14,129.44
Year 20 =	72,117.68	Year 20 =	13,733.29
+ Sv =	125,364.23	+ Co =	485,120.00
		- Sv =	125,364.23
	1,574,858.76		724,364.23

NPV (B - C) = 850,385.00

Ratio (B / C) = 2.17

APPENDIX J

DETAILED COSTING OF EXISTING SQUATTER SETTLEMENT

Cost of existing squatter settlement is calculated by the author with the help of quantity surveyor. Calculations are based on existing infrastructure and housing cost provided by the City Hall.

DEVELOPMENT COST

A Land	$ per hectare
No cost on land	0
B Infrastructute Cost	
1. Public standpipes i.e., 0.2 @ 500.00	100.00
2. Road Improvement	2,000.00
3. Electrical reticulation	2,000.00
4. Public phones i.e., 0.06 @ 250.00	3.00
Total	4,203.00
C Building Cost	
17 @ 7,500.00	127,500.00
TOTAL DEVELOPMENT COST	131,703.00

REVENUE

Revenue or benefit of the project is obtained from annual rental value of the houses. i.e., $100.00 per month per unit. A detailed computation of the present value of the costs and benefits of the project at 7 percent interest rate are presented here. Refer to main text for the assumption and rationales used in the computation.

PRESENT VALUE OF BENEFIT AND COST OF JINJANG/KEPONG SQUATTER SETTLEMENT

BENEFIT

$$Bi = \sum_{t=0}^{n} \frac{Bi_t(1+f)^t + Sv}{(1+k)^t}$$

Bi = Benefit from annual rental value:
year 1 = $10,200.00; year 2 = $15,300.00;
year 3 through year 20 = $20,400.00;

Sv = $131,703.00 (salvage value);

f = 6.5% (annual inflation rate for gross rent);

k = 7% interest rate;

n = 20 years;

t = the time period.

COST

$$Ci = \sum_{t=0}^{n} Co + \frac{Cm_t(1+f)^t - Sv}{(1+k)^t}$$

Co = $131,703.00 (initial cost);

Cm = $6,585.50 (maintenance cost at 5% of development cost);

Sv = $131,703.00 (salvage value);

f = 4% (annual inflation rate for goods and services);

k = 7% interest rate;

n = 20 years period;

t = the time period.

Present Value Benefit and Cost at 7 percent interest rate

Benefit $		Cost $	
Year 1 =	10,153.34	Year 1 =	6,433.57
Year 2 =	19,868.19	Year 2 =	6,253.19
Year 3 =	20,115.35	Year 3 =	6,077 86
Year 4 =	20,021.36	Year 4 =	5,907.46
Year 5 =	19,927.80	Year 5 =	5,741.83
Year 6 =	19,834.68	Year 6 =	5,580.84
Year 7 =	19,741.99	Year 7 =	5,424.37
Year 8 =	19,649.74	Year 8 =	5,272.37
Year 9 =	19,557.92	Year 9 =	5,124.46
Year 10 =	19,466.53	Year 10 =	4,980.79
Year 11 =	19,375.56	Year 11 =	4,841.14
Year 12 =	19,285.03	Year 12 =	4,705.40
Year 13 =	19,194.91	Year 13 =	4,573.48
Year 14 =	19,105.21	Year 14 =	4,445.25
Year 15 =	19,051.93	Year 15 =	4,320.62
Year 16 =	18,927.07	Year 16 =	4,199.48
Year 17 =	18,838.63	Year 17 =	4,081.73
Year 18 =	18,750.60	Year 18 =	3,967.29
Year 19 =	18,662.98	Year 19 =	3,856.07
Year 20 =	18,575.77	Year 20 =	3,747.95
+ Sv =	34,210.28	+ Co =	32,383.00
		- Sv =	34,210.28
	412,278.87		197,707.78

NPV (B - C) = 214,571.09
Ratio (B / C) = 2.09

APPENDIX K

COST-BENEFIT OF ALTERNATIVE DEVELOPMENT PROPOSAL

ALTERNATIVE 1

Costs

		Millions $
1	Low-cost Housing i.e., 83.6 @ 4.82	403.24
2	Resettlement cost i.e., 2134 @ 15,000.00	30.50
		433.74

Benefits

1	Low-cost Housing i.e., 83.6 @ 7.12	595.65

NPV (B - C) = 161.9

Ratio (B / C) = 1.37

ALTERNATIVE 2

Cost

		Millions $
1	Low-cost Housing i.e., 43.1 @ 4.82	207.74
2	Site and Services i.e., 23.3 @ 2.07	48.27
3	Upgrading i.e., 17.2 @ 0.85	14.65
4	Resettlement cost i.e., 1581 @ 15,000.00	23.72
		294.38

Benefits

1	Low-cost Housing i.e., 43.1 @ 7.12	306.87
2	Site and Services i.e., 23.3 @ 5.14	119.86
3	Upgrading i.e., 17.2 @ 1.57	22.07
		453.80

NPV (B - C) = 159.42

Ratio (B / C) = 1.54

ALTERNATIVE 3

Cost		Millions $
1	Low-cost i.e., 66.4 @ 4.82	320.14
2	Upgrading i.e., 17.2 @ 0.85	14.65
3	Resettlement Cost i.e., 1581 @ 15,000,00	23.72
	Total Cost	358.51

Benefits		
1	Low-cost Housing i.e., 66.4 @ 7.12	472.91
2	Upgrading i.e., 17.2 @ 1.57	27.07
	Total Benefit	499.98

NPV (B - C) = 141.47

Ratio (B / C) = 1.39

ALTERNATIVE 4

Cost		Millions $
1	Low-cost Housing i.e., 32.4 @ 4.82	136.27
2	Site and Services i.e., 23.3 @ 2.07	48.27
3	Upgrading i.e., 27.8 @ 0.85	23.68
4	Resettlement Cost i.e., 1421 @ 15,000.00	21.31
	Total Cost	249.76

Benefit		
1	Low-cost Housing i.e., 32.4 @ 7.12	231.19
2	Site and Services i.e., 23.3 @ 5.14	119.86
3	Upgrading i.e., 27.8 @ 1.57	43.76
	Total Cost	394.81

NPV (B - C) = 145.05

Ratio (B / C) = 1.58

APPENDIX L

```
/* name: SQPLAN.COM - START PROGRAM FOR SQPLAN FROM VAX
/*                    POMPT
/*

$ARC50
$WRITE SYS$OUTPUT " "
$WRITE SYS$OUTPUT " "
$WRITE SYS$OUTPUT "     *******   LOADING SQPLAN   *******"
$ARC
&TYPE ' '
&TYPE '     *****  LOADING SQPLAN, PLEASE WAIT  ***** '
&RUN SQPLAN.AML
QUIT
$EXIT
```

APPENDIX M

```
1 name: SQPLAN.MENU - menu for squatter planning
EXISTING
 Sq_building &run SQBUILD.AML
 L_use &run USE.AML
 Utilities &run UTL.AML
 Ownership &run OWNER.AML
 L_Value &run VALUE.AML
SQ_POLICY
 Resettlement &run SQPOLICY.AML 1
 Improvement &run SQPOLICY.AML 2
 Upgrading &run SQPOLICY.AML 3
 No_Action &run SQPOLICY.AML 4
 Map_Layout &run POLLAYOUT.AML
SQ_PROGRAMME
 Demolition &run UPGPROGR.AML 1
 Improvement &run UPGPROGR.AML 2
 Move_out &run UPGPROGR.AML 3
HS_POLICY
 Low_cost_Housing &run HSPOLICY.AML 1
 Site_and_Services &run HSPOLICY.AML 2
STOP &tty
SYSTEM &system
QUIT QUIT
```

```
7 NAME: RESEL.MENU  Specify Search Routine for coverage
                    reselection
 Date: %today

 Currently Selected Coverage:%curcov

 Search Expression: %searexp

   %servals1                          %servals2


   %searits              %help       %cancel                %ok


%today    display datevar 32
%curcov   display .rescov 25
%searexp  input .serexp 50 init ' ' required size 100 -
           next %ok help 'See SEARCH ITEMS for information' -
           character
%ok       button OK &s .do Y; &return
%cancel   button cancel 'CANCEL' &s .do N; &return
%help     button return keep 'HELP' &popup resel.txt 30 55

%servals1 button return keep 'SEARCH VALUES (SQPOLICY)' -
           &menu serval1.menu
%servals2 button return keep 'SEARCH VALUES (UPGRADING)' -
           &menu serval2.menu
%searits  button return keep 'SEARCH ITEMS' &r serit
%formopt  nextfield same
%forminit &s datevar := [date -cal]
```

APPENDIX O

```
3 NAME:  SERVAL1.MENU - menu for search values
                         (squatter policy)
1 0
Items
FLOOD &run POLVAL 1
OWN   &run POLVAL 2
OWND  &run POLVAL 3
VAL   &run POLVAL 4
PRLU  &run POLVAL 5
PRLST &run POLVAL 6
PRLPD &run POLVAL 7
PRLDV &run POLVAL 8
Quit  &return
```

```
3 NAME:  SERVAL2.MENU  - menu for search values
                         (squatter upgrading)
1 0
Items
BUS &run UPGVAL 1
CON &run UPGVAL 2
RM  &run UPGVAL 3
POP &run UPGVAL 4
FM  &run UPGVAL 5
DS  &run UPGVAL 6
RE  &run UPGVAL 7
OC  &run UPGVAL 8
INC &run UPGVAL 9
DW  &run UPGVAL 10
MT  &run UPGVAL 11
HP  &run UPGVAL 12
RP  &run UPGVAL 13
PP  &run UPGVAL 14
LP  &run UPGVAL 15
DBU &run UPGVAL 16
MP  &run UPGVAL 17
Quit  &return
```

APPENDIX P

```
/* name: SQPLAN.AML -squatter planning menu driven approach
/*                    top level procedure
/*
ARCPLOT
&s .disp [response 'Please Enter Display']
DISPLAY %.disp%
&term %.disp%
&dalines 3
&menu SQPLAN.MENU
```

APPENDIX Q

```
/* AML NAME: SQPOLICY.AML
/*
/*            SQPOLICY.AML programme to allow user to
/*            reselect area for specific squatter policy
/*            (resettlement, improvement, upgrading or no
/*            action) and calculate area (in Hectare) and
/*            Cost-Benefit Analysis of selected policy

/* Select the specific squatter policy
&args .menuvalue
&s .rescov [response 'Please Enter Coverage']

/* Determine the type of the current coverage
&if [exists %.rescov% -POLY] &then
 &do
  &s .covty -POLYGON
  &s .covtype POLYS
 &end
&else
 &do
  &type WARNING...... coverage is not a polygons coverage
  &type Please try again
  &return
 &end

/* Display the reselect coverage menu.
&menu resel.menu

&messages &popup
&if %.do% = N &then
 &do
  &type 'Cancellation of Reselect Coverage.'
  &return Returning to Main Menu ...
 &end

/* Echo the search expression to the terminal.
&type 'Full search expression:'
&type %.serexp%

&s covsort [trim %.covty% -left -]

/* Execute the reselect expression.
resel %.rescov% %covsort% %.serexp%

/* Set up map composition
mapex %.rescov%
pagesize 11 8
maplimits 1.35 1.35 8.35 6.35
mapscale automatic
mapposition cen cen
```

```
/* Draw Squatter Building if desired
   &if [query 'Do you want Building to be Displayed  Y/N ~
        (Y)' .TRUE.] &then
    polygons UP2BL

/* Draw the selected set if desired.
  &select %.menuvalue%
 /* Squatter Resettlement
  &when 1
   &do
    &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
        &then
     polygonshade %.rescov% 50
    &if [query 'Do you want summary statistics Y/N (N)' ~
        .FALSE.] &then
    &do
     &type Summary statistics for coverage %.rescov% for
     &type Resettlement Area are being calculated. Your
     &type reselect expression was %.serexp%. The
     &type statistics calculated are Frequency, Sum Area
     &type (Ha), Mean Area (Ha), Max Area (Ha) and Min
     &type Area (Ha)
     statistics %.rescov% %covsort%
     sum AREA_H
     mean AREA_H
     max AREA_H
     min AREA_H
     end
    &end
   &end

 /* Improvement Area
  &when 2
   &do
    &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
        &then
     polygonshade %.rescov% 22
    &if [query 'Do you want summary statistics Y/N (N)' ~
        .FALSE.] &then
     &do
      &type Summary statistics for coverage %.rescov% for
      &type Improvement Area are being calculated. Your
      &type reselect expression was %.serexp%. The
      &type statistics calculated are Frequency, Sum Area
      &type (Ha), Mean Area (Ha), Max area (Ha) and Min
      &type Area (Ha).
     statistics %.rescov% %covsort%
     sum AREA_H
     mean AREA_H
     max AREA_H
     min AREA_H
     end
     &end
  &end
```

```
 /* Upgrading Area
   &when 3
    &do
     &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
          &then
      polygonshade %.rescov% 51
     &if [query 'Do you want summary statistics Y/N (N)' ~
          .FALSE.] &then
      &do
       &type Summary statistics for coverage %.rescov% for
       &type Upgrading Area are being calculated. Your
       &type reselect expression was %.serexp%. The
       &type Statistics calculated are frequency, Sum
       &type area (H) Mean Area (H), Sum Upgading Cost
       &type (million  $) and Sum Upgrading Benefit
       &type (million  $).
      statistics %.rescov% %covsort%
      sum AREA_H
      mean AREA_H
      sum UP_COST
      sum UP_BEN
      end
     &end
    &end

 /* No Action
   &when 4
    &do
    &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
         &then
     polygonshade %.rescov% 23
    &if [query 'Do you want summary statistics Y/N (N)' ~
         .FALSE.] &then
     &do
      &type Summary statistics for coverage %.rescov% for
      &type No Action Area are being calculated. The
      &type statistic calculated are Sum Area (H), Mean
      &type Area (H), Max Area Area (H) and Min Area (H)
     statistics %.rescov% %covsort%
     sum AREA_H
     mean AREA_H
     Max AREA_H
     Min AREA_H
     end
     &end
   &end
&end

/* Check that the reselect should be cleared. In normal
/* cases it should be to avoid problems later on. If it
/* is not cleared it will remain in force until a clearsel
/* command is given.
```

```
  &if [query 'Should the reselect be cleared Y/N (Y)' ~
      .TRUE.] &then
   &do
    clearsel
   &end
   &else
    &do
     &type WARNING ... Only selected set of features is
     &type available for further use with this coverage.
     &type Use Clearsel from the terminal to remove
     &type reselection
    &end
&end
 &RETURN
```

APPENDIX R

```
/* AML NAME: HSPOLICY.AML
/*
/*             SQPOLICY.AML programme to allow user to
/*             reselects area for specific housing policy
/*             for squatter (Low-cost housing and Site and
/*             services  area) and calculated the area
/*             (in hectare) and Cost-Benefit Analysis
/*             (in million  $)

/* Select the specific housing policy
&args .menuvalue
&s .rescov [response 'Please Enter Coverage']

/* Determine the type of the current coverage
&if [exists %.rescov% -POLY] &then
 &do
  &s .covty -POLYGON
  &s .covtype POLYS
 &end
&else
 &do
  &type WARNING...... coverage is not a polygons coverage
  &type Please try again
  &return
 &end

/* Display the reselect coverage menu.
&menu resel.menu

&messages &popup
&if %.do% = N &then
 &do
  &type 'Cancellation of Reselect Coverage.'
  &return Returning to Main Menu ...
 &end

/* Echo the search expression to the terminal.
&type 'Full search expression:'
&type %.serexp%

&s covsort [trim %.covty% -left -]

/* Execute the reselect expression.
resel %.rescov% %covsort% %.serexp%

/* Set up map composition
mapex %.rescov%
pagesize 11 8
maplimits 1.35 1.35 8.35 6.35
mapscale automatic
mapposition cen cen
```

```
/* Draw Squatter Building if Desired
   &if [query 'Do you want buildings to be displayed Y/N ~
       (Y)' .TRUE.] &then
     polygons UP2BL

/* Draw the selected set if desired.
  &select %.menuvalue%

/* Low-cost Housing
  &when 1
   &do
    &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
        &then
     polygonshade %.rescov% 52
    &if [query 'Do you want summary statistics Y/N (N)' ~
        .FALSE.] &then
    &do
     &type Summary statistics for coverage %.rescov% for
     &type Low-cost Housing are being calculated. Your
     &type reselect expression was %.serexp%. The statistics
     &type calculated are Frequency, Sum Area (Ha), Mean
     &type Area (Ha), Sum Cost of Development (in million  $)
     &type and Benefit of Development (in million  $)
     statistics %.rescov% %covsort%
     sum AREA_H
     mean AREA_H
     sum LH_COST
     sum LH_BEN
     end
    &end
   &end

 /* Site and Services Project
  &when 2
   &do
    &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
        &then
     polygonshade %.rescov% 24
    &if [query 'Do you want summary statistics Y/N (N)' ~
        .FALSE.] &then
     &do
      &type Summary statistics for coverage %.rescov% for
      &type Site and Services Area are being calculated.
      &type Your reselect expression was %.serexp%. The
      &type statistics calculated are Frequency, Sum Area
      &type (Ha), Mean Area (Ha), Sum Cost of Development
      &type (million  $) and Benefit of Development
      &type (million  $)
    statistics %.rescov% %covsort%
    sum AREA_H
    mean AREA_H
    sum SS_COST
    sum SS_BEN
    end
    &end
  &end
 &end
```

```
/* Check that the reselect should be cleared. In normal
/* cases it should be to avoid problems later on. If it
/* is not cleared it will remain in force until a clearsel
/* command is given.

  &if [query 'Should the reselect be cleared Y/N (Y)' -
      .TRUE.] &then
   &do
    clearsel
   &end
   &else
    &do
     &type WARNING ... Only selected set of features is
     &type available for further use with this coverage.
     &type Use Clearsel from the terminal to remove
     &type reselection
    &end
&end

&RETURN
```

APPENDIX S

```
/* AML NAME: UPGPROGR.AML
/*
/*            UPGPROGR.AML Programme to allow reselect

/*            specific building for demolition or
/*            improvement and display statistics (Area,
/*            Cost and Benefit)

&arg .menuvalue
&label TOP
&s .rescov [response 'Please Enter Coverage']

/* Determine the type of the current coverage
&if [exist %.rescov% -POLY] &then
 &do
  &s .covty -POLYGON
  &s .covtype POLYS
 &end
&else
 &do
  &type WARNING... coverage is not polygons coverage
  &type or illegal coverage... Please try again....
  &goto TOP
 &end

/* Set up map composition
MAPEX %.rescov%
PAGESIZE 8 10
MAPLIMITS .5 .5 6 8.5
MAPUNITS 0.00126262
MAPSCALE 5000
MAPPOSITION CEN CEN

/* Draw squatter buildings if desired
 &if [query 'Do you want buildings to be displayed Y/N ~
     (Y) .TRUE.] &then
   polygons SQUPG

/* Display the reselect coverage menu
&menu resel.menu

&message &popup
&if %.do% = N &then
 &do
  &type 'Cancelation of Reselect coverage.'
  &return Returning to the Main Menu ..............
 &end

/* Echo the search expression
&type 'Full search expression'
&type %.serexp%

&s covsort [trim %.covty% -left -]
```

```
/* Execute the reselect expression
resel %.rescov% %covsort% %.serexp%

/* Draw the selected set if desired
&select %.menuvalue%

/* Buildings demolition
&when 1
 &do
  &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
      &then
   polygonshade %.rescov% 74
  &if [query 'Do you want summary statistics Y/N (Y)' ~
      .FALSE.] &then
   &do
   statistics %.rescov% %covsort%
   sum AREA
   sum FM
   sum POP
   end
  &end
 &end

/* Housing Improvement
&when 2
 &do
  &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
      &then
   polygonshade %.rescov% 75
  &if [query 'Do you want summary statistics Y/N (Y)' ~
      .FALSE.] &then
   &do
    statistics %.rescov% %covsort%
    sum AREA
    sum RM
    sum FM
    sum POP
    end
   &end
  &end

/* Encourage to move out
&when 3
 &do
  &if [query 'Shade selected polygons Y/N (Y)' .TRUE.] ~
      &then
   polygonshade %.rescov% 50
  &if [query 'Do you want summary statistics Y/N (Y)' ~
      .FALSE.] &then
   &do
    statistics %.rescov% %covsort%
    sum AREA
    sum FM
    sum POP
    end
   &end
  &end
```

```
&end

/* Display detailed squatter information if desired
&if [query 'Do you want detailed squatter information ~
     Y/N (Y)' .TRUE.] &then
 &do
  LIST %.rescov% %.covtype%
 &end
&end

/* Check that the reselect should be cleared
&if [query 'Should the reselect be cleared Y/N (Y)' ~
    .TRUE.] &then
 &do
  clearsel
 &end
&else
 &do
  &type WARNING.... Only selected set of features is
  &type available for further use with this coverage.
  &type Use Clearsel from the terminal to remove
  &type reselection
 &end
&end


/* Cartographic detail
&if [query 'Do you want upgrading boundary Y/N (Y)' ~
    .TRUE.] &then
 &do
  polygons UPG
 &end
&if [query 'Do you want cartographic detail Y/N (Y)' ~
    .TRUE.] &then
 &call CARTO
&if [query 'Do you want locational map Y/N (Y)' ~
    .TRUE.] &then
 &call LOCATIONAL
&if [query 'Do you want north arrow Y/N (Y)' ~
    .TRUE.] &then
 &call ARROW
&if [query 'Do you want map scale Y/N (Y)' ~
    .TRUE.] &then
 &call SCALE
&if [query 'Do you want legend Y/N (Y)' ~
    .TRUE.] &then
 &call LEGEND

&RETURN

/* Cartographic detail
&routine CARTO
BOX .25 0 8 10
BOX .5 .5 6 8.5
MOVE .5 .15
TEXTFONT 10
TEXTSPACING 1.1
```

```
TEXTSIZE .12
TEXT 'Compiled by Ahris Yaakup on ARC/INFO, July 1990'
MOVE 1.4 9.4
TEXTFONT 1
TEXTSPACING 1.1
TEXTSIZE .18
TEXT 'JINJANG/KEPONG SQUATTER SETTLEMENT'
MOVE 2 9
TEXTFONT 9
TEXTSPACING 1.1
TEXTSIZE .24
TEXT 'UPGRADING PROGRAMME'
&return

/* Locational Map
&routine LOCATIONAL
BOX 6.2 6.5 7.8 8.5
MAPEX LOCAT
MAPLIMIT 6.2 6.5 7.8 8.5
MAPSCALE AUTOMATIC
MAPPOSITION CEN CEN
POLYGONS LOCAT
POLYGONSHADE LOCAT LOCAT LOCAT.SYM
&return

/* North Arrow
&routine ARROW
MOVE 7 6.175
TEXTFONT 1
TEXTSIZE .15
TEXT 'N'
MAPEX NORTHARR
MAPLIMITS 6.3 4.8 7.8 6.1
ARCS NORTHARR
&return

/* Map scale
&routine SCALE
MOVE 6.3 4.4
TEXTFONT 1
TEXTSIZE .13
TEXT 'Scale  1:5,000'
&return

/* Legend
&routine LEGEND
MOVE  6.3 3.5
TEXTFONT 10
TEXTSIZE 0.1
TEXT 'Legend'
KEYPOSITION 6.3 3
KEYSEPARATION 0.1 0.15
KEYBOX .3 .2
KEYSHADE PRUPG.LEG
&return
```

APPENDIX T

```
/* Name :  UPGVAL.AML     Search Items Values for Squatter
/*                        Upgarding Programme

/*
&args .menuvalue

/* list of values for selected items
&select %.menuvalue%

/* selected items from upgrading database
 &when 1
  LIST BUS.SYM
 &when 2
  LIST CON.SYM
 &when 3
  LIST RM.SYM
 &when 4
  LIST POP.SYM
 &when 5
  LIST FM.SYM
 &when 6
  LIST DS.SYM
 &when 7
  LIST RE.SYM
 &when 8
  LIST OC.SYM
 &when 9
  LIST INC.SYM
 &when 10
  LIST DW.SYM
 &when 11
  LIST MT.SYM
 &when 12
  LIST HP.SYM
 &when 13
  LIST RP.SYM
 &when 14
  LIST PP.SYM
 &when 15
  LIST LP.SYM
 &when 16
  LIST DBU.SYM
 &when 17
  LIST MP.SYM

&end

&RETURN
```

APPENDIX U

```
/* Name :  POLVAL.AML      Search Values for Items in Database
/*                         for squatter policies

/*
&args .menuvalue

/*select the item from menu
&select %.menuvalue%

/* Display the value for individual item
  &when 1
   LIST FLOOD.SYM
  &when 2
   LIST OWN.SYM
  &when 3
   LIST OWND.SYM
  &when 4
   LIST VAL.SYM
  &when 5
   LIST PRLU.SYM
  &when 6
   LIST PRLST.SYM
  &when 7
   LIST PRLPD.SYM
  &when 8
   LIST PRLDV.SYM

  &end

&RETURN
```